The Electrical Industry's Weekly Magazine

June 30, 1958

Electrical World

Price 50 Cents

A McGraw-Hill Publication

Electric Heating: "Dollars and Sense for a Utility..."

page 41

Washington Recap . . . p 36

E B POWER GS W 1
UNIVERSITY MICROFILMS IN
313 N 1 ST
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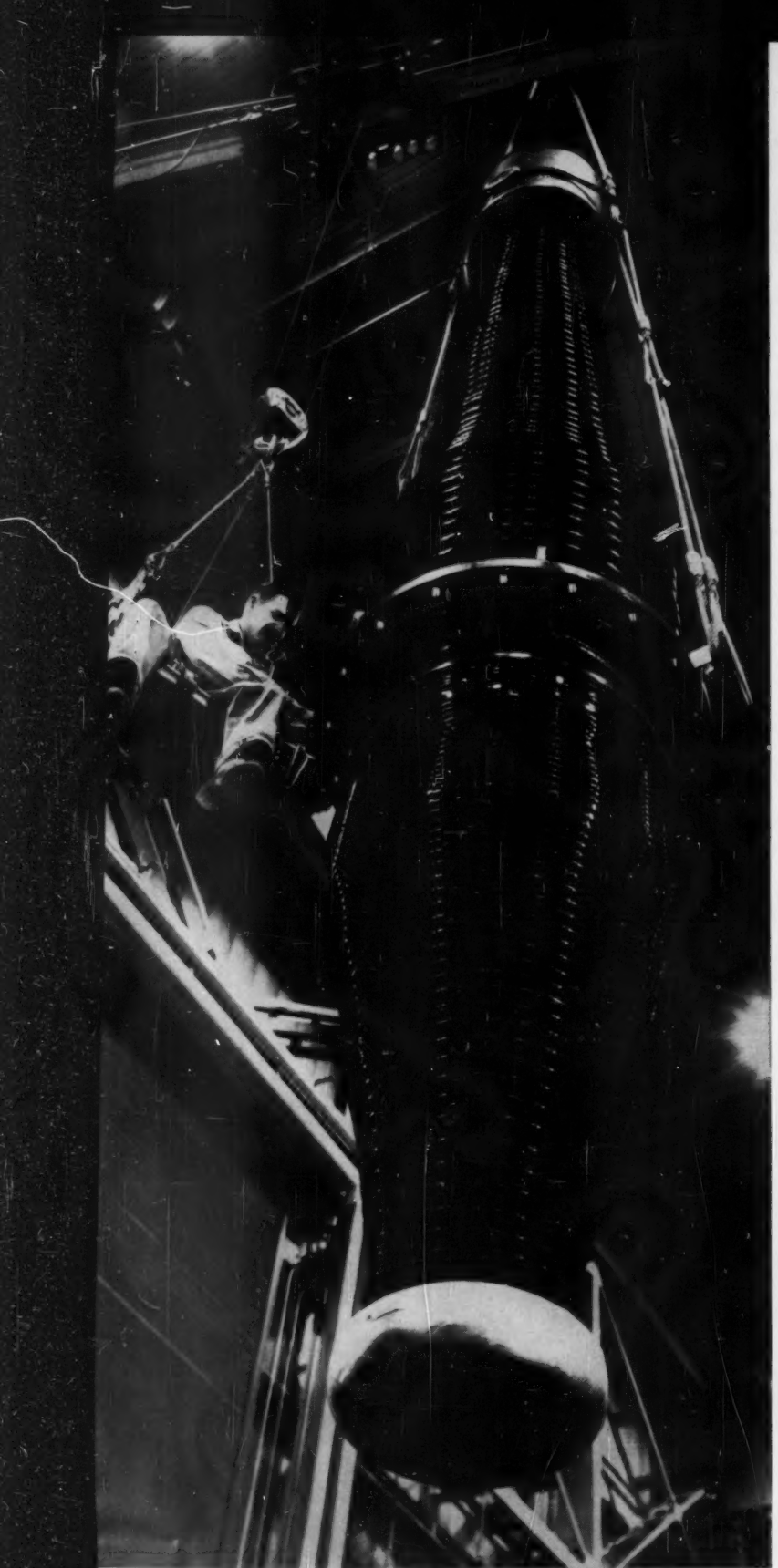

World's Largest Bushings, for 650-kv power transformers, will be used in General Electric's prototype EHV system. Technician at Company's Power Transformer Dept. prepares bushing for oil tank testing.

Project Manager Dr. P. A. Abetti and J. W. Seaman, Power Transformer Dept. General Manager, compare size of workmen (circle) to EHV tower model.

Free-enterprise companies undertake unprecedented research project . . .

Announcing new advance toward world leadership in EHV

Project EHV demonstrates that our free society has vitalities superior to any totalitarian system. Western Massachusetts Electric Company, Stone & Webster Engineering Corporation, Aluminum Company of America, 15 General Electric departments, and a supplier of steel towers, will participate in the construction in 1959, of a complete extra-high-voltage power system. Extending more than four miles in Massachusetts' Berkshire Hills, the system will operate from 460 to 650 kv a-c with a maximum voltage of 750 kv. In 1963 the line may even be rebuilt for 1,000 kv a-c or d-c.

To the U.S. this means a giant stride toward extending progress made in this area, here and in Europe since the war. At least a dozen experimental lines all over the world have provided EHV data up to 600 kv—data that have been the basis for the voltages presently used (345 kv in America and 380–400 kv in Europe, with Russia planning to operate at 500 kv in 1959).

To America's utilities this means a vital source of information on: lightning and switching surges, low-frequency overvoltages and nonstandard surges, reduced BIL, ice formation and removal, galloping conductors, radio-TV interference and corona losses, insulation life, mechanical stresses on the conductors and towers, optimum patterns of growth of transmission systems and right of way, relaying, telemetering, EHV standardization, and data processing.

For more information on Project EHV, write for bulletin GED-3262, or contact your local G-E Apparatus Sales Office. Section 301-391, General Electric Company, Schenectady 5, New York.

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 149, No. 26 JUNE 30, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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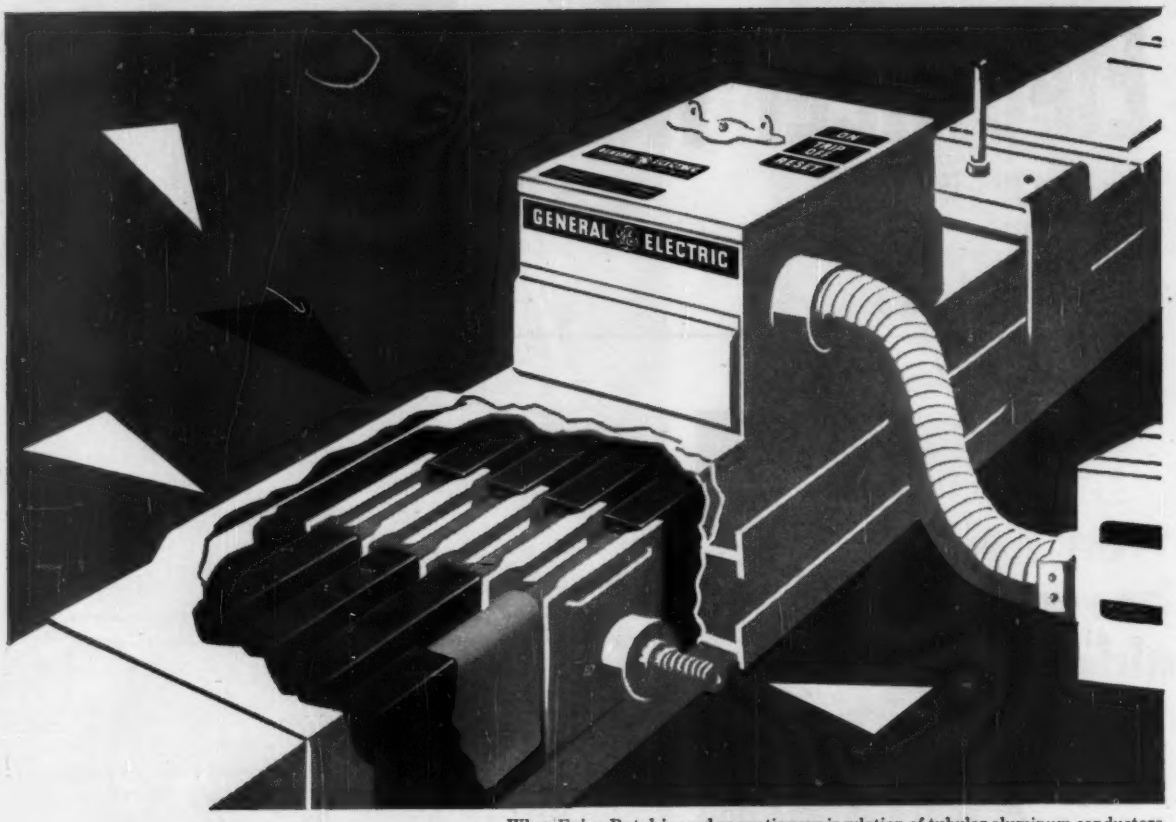

When Enjay Butyl is used as continuous insulation of tubular aluminum conductors, traveling arcs are virtually eliminated, plug outlets are essentially dead-front.

ENJAY BUTYL

helps keep costs low in new Aluminum Busway!

Enjay Butyl is extruded over the full length of the conductors used in General Electric's new Type DE Busway, the first busway designed specifically for aluminum. This new busway incorporates all 22 features that engineers consider important in busway design, yet it is up to 30% smaller and 50% lighter than other busways of comparable rating.

Enjay Butyl rubber is ideal for use as continuous insulation of tubular conductors because of its inherent resistance to ozone and to heat aging. Add Butyl's excellent electrical properties, its vulcanizability and the fact that it is the *lowest cost* rubber on the market—and you'll understand why it was chosen above all other rubbers to do this job.

Every day manufacturers are discovering new ways to use economical Butyl. Find out how Enjay Butyl rubber can cut production costs for you. For further information and expert technical assistance, contact the Enjay Company.

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CIGRE 1958-Progress Through Cooperation

The slide rule may yet displace the olive branch as a symbol of peace, judging from early dispatches from CIGRE, the International Conference on Large Electric Systems that met in Paris this month.

Our special correspondent, John Sykes of Bedford, England, himself a member of the CIGRE dc study committee and a veteran engineering editor, writes that again CIGRE 1958 has shown the value of international cooperation in the electrical field.

For the first time, John says, there was complete freedom of exchange on the technical level between East and West and among all countries attending the conference.

Russian engineers, in particular, were free and willing to meet delegates from the United States, Great Britain and elsewhere . . . alone or together. And it was obvious that they spoke with complete freedom.

"It was," John writes, "particularly interesting to find American and Russian engineers continuing their formal conference discussion exchanges outside the room, out in the street, and even over a glass in a Parisian cafe."

For an insight into the character of these exchanges, their content, and significance, look to the full report by Sykes in the July 7 issue.

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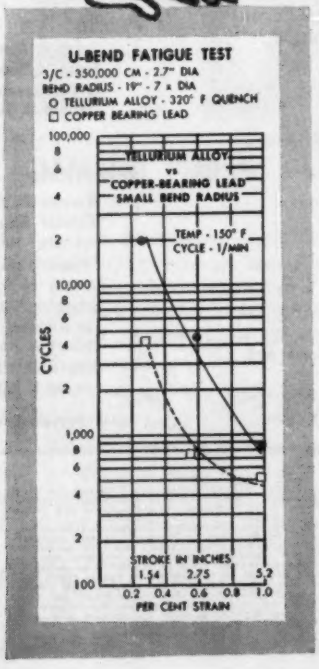
ROEBLING'S TELLURIUM LEAD ALLOY SHEATH LASTS 4½ TIMES AS LONG!



It's been proved in laboratory tests—the Tellurium Lead Alloy Sheath on Roebling Paper Power Cable has *4½ times more bending life* than copper bearing lead sheath! What's more, tests (and experience) prove this sheath has outstanding stability under heat... unusual resistance to age hardening... negligible creep rate at 200 psi, 150°F

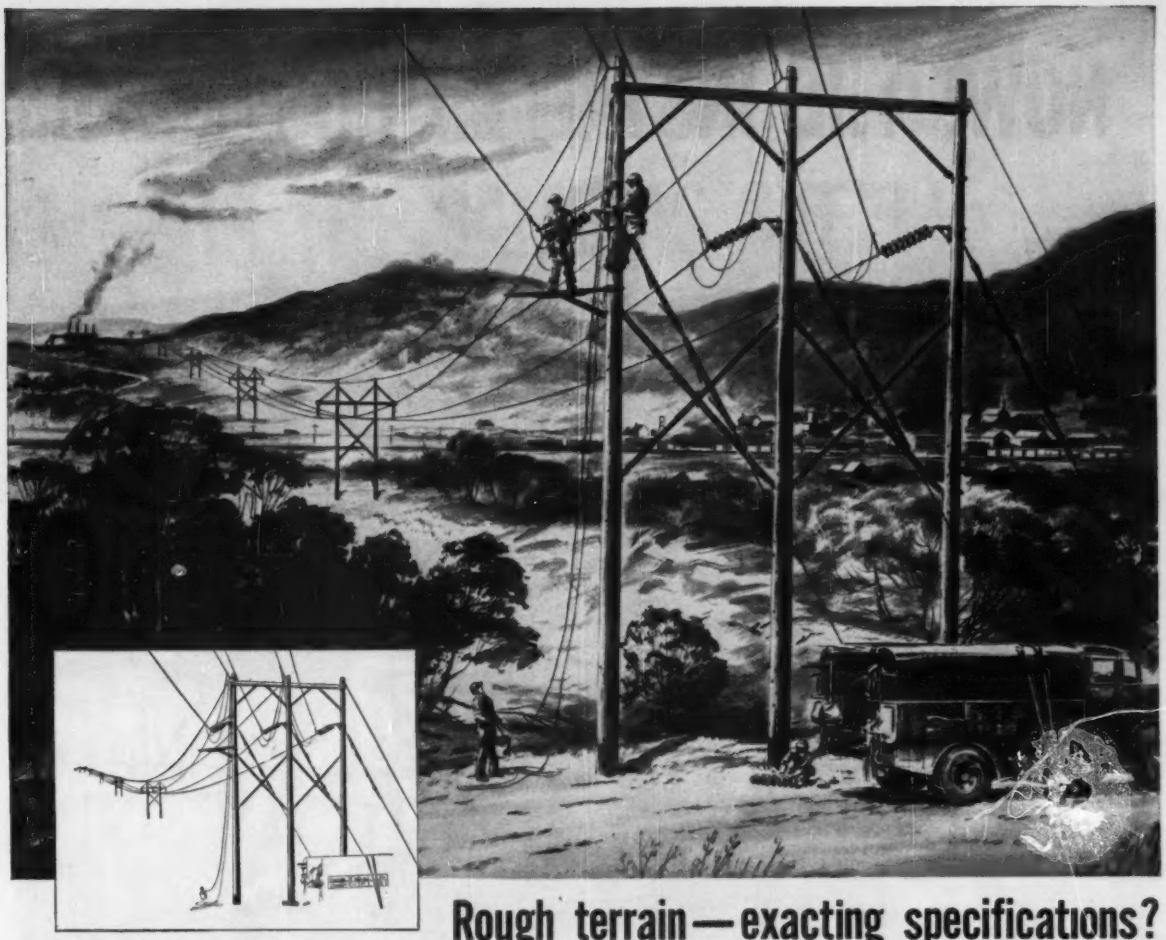
The paper power cable inside matches the extra quality of the sheath. And that's the whole story—there's simply no better cable buy, when the cable you use has to last, then last some more!

Test data and an informative folder about the exceptional properties of this sheath are available. Write: Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

Roebling electrical wires and cables are available with either copper or aluminum conductors.



You can get prompt help with any outside construction problem through your Graybar office. In over 130 cities there are Graybar offices and warehouses ready to fill your every need for line materials, hardware and tools. And through any of these offices you can get the help of Graybar Outside Construction Specialists, strategically located in 19 principal cities, equipped by training and experience to give you prompt, dependable help.

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Line building can challenge the skill and ingenuity of the best transmission engineers. When the line runs through rugged country, when the specifications are precise, take full advantage of the broad facilities and specialized experience of Graybar. No matter where your job site may be located, no matter what new requirements may be presented in tensions, insulation and erection, call on Graybar for engineering assistance as well as all your transmission line materials and supplies. If you would like to see our bulletin on High Voltage Transmission Line Materials, and you are located in the U. S. or its possessions, write us for your copy. It's complete with illustrations, applications and specifications. It is free, of course. 710

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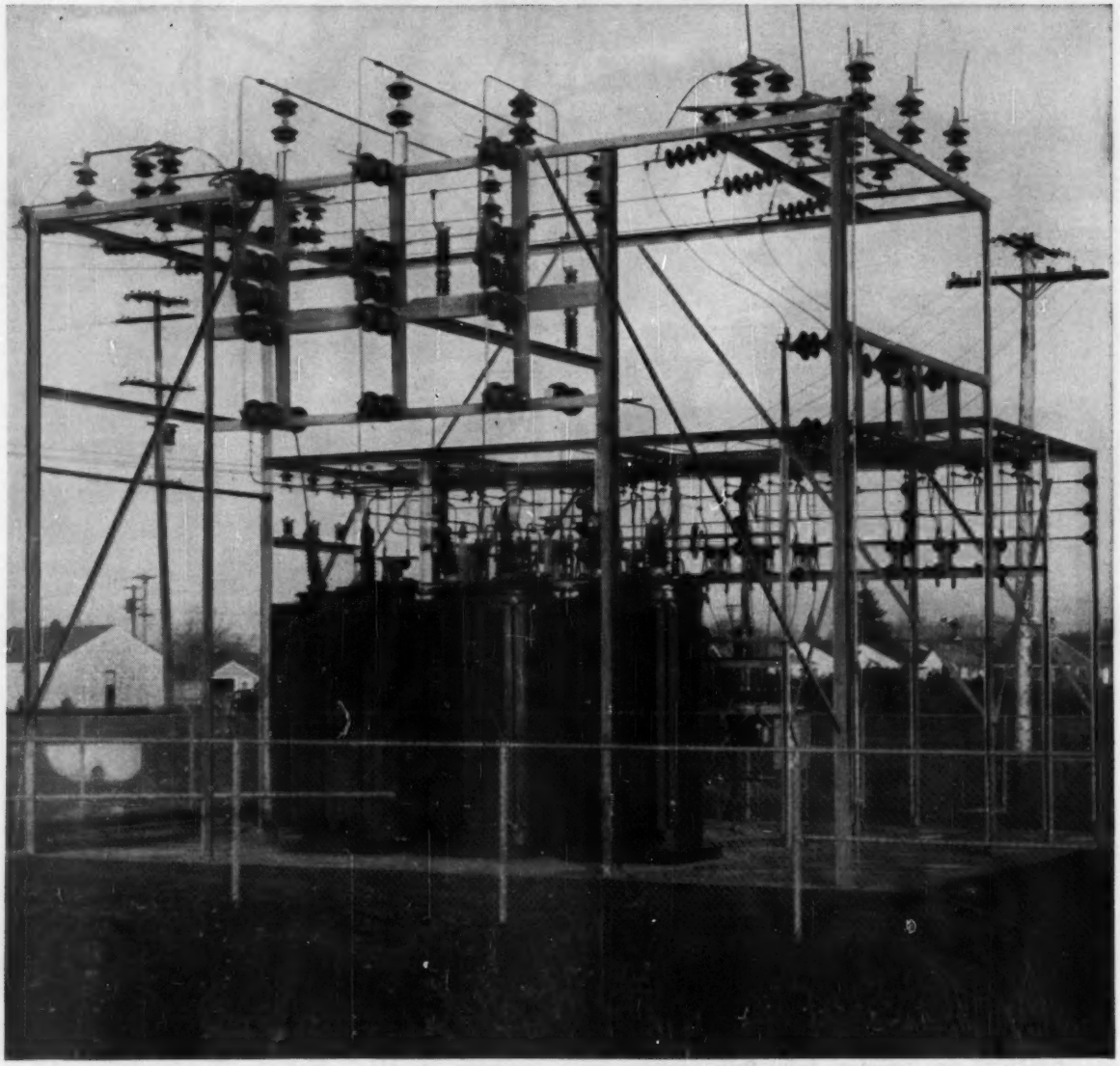

THE INSTALLED COST of this aluminum substation structure was actually less than steel. Public Utility District No. 1 of Cowlitz County, Longview, Washington. O. G. Hittle, Manager; Donald Hughes, Chief Engineer.

KAISER ALUMINUM supplies leading fabricator-erectors with high quality American standard extruded angles, channels and "I" beams. We will be happy to refer you to substation structure fabricators who are ready to quote realistic prices on aluminum.

ALUMINUM SUBSTATION STRUCTURE IS THE SAME AS STEEL!

COST OF ALUMINUM VS. GALVANIZED STEEL SUBSTATION STRUCTURES*

	3 ALUMINUM STRUCTURES BOLTED CONSTRUCTION Weight: 19,900 lbs.	3 STEEL STRUCTURES BOLTED CONSTRUCTION Weight: 59,700 lbs.
Total Installed Cost of Structures	$15,186	$17,313
Cost per pound of Structures, Installed	76¢	29¢

*Based on cost figures for 69/12.5 KW aluminum substation structure as compared to an equivalent galvanized steel structure. All work was performed by the utility.

Note in the figures above that the installed cost of the three aluminum structures is actually *less* than steel. Savings were principally realized through lower fabrication and erection costs. For most aluminum structures, installed costs are about equal to steel. *But here the equality ends!*

A BONUS! NO MAINTENANCE!

The high maintenance costs of steel keep mounting as long as the structure stands. Steel structures in corrosive areas require two coats of paint every five years to prevent rust and corrosion. Costs of rehabilitating a steel structure can run as high as 5 to 12 cents per pound of structure.

On the other hand, aluminum structures can't rust, resist corrosion, never need painting—maintenance costs are eliminated. *You pay nothing above the installed cost of the structure.*

Get This Free Substation Booklet! ▶

New 48-page booklet fully explains the many advantages of aluminum, offers complete design information. Mail the coupon now!

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Find out how aluminum can meet your substation structure requirements more efficiently at less cost. Kaiser Aluminum's experienced engineers are available, without charge or obligation, to assist you with any substation structure problem.

Further assistance is available for any application of aluminum in the Power Industry—aluminum electrical conductors, components for bus systems, boiler lagging, insulation jacketing, structurals, roofing and siding.

For immediate service, contact the Kaiser Aluminum sales office listed in your telephone directory. Or write: *Kaiser Aluminum & Chemical Sales, Inc., Dept. EW-1, 919 North Michigan Avenue, Chicago 11, Illinois.*

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Gentlemen:

Please send me your free booklet, *"Aluminum Substation Structures."*

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4-step finish gives lasting protection

Thousands of installations have proved the long-lasting quality of the Pole Star four-step finish. It begins with shot-blasting of all external surfaces, to remove scale, grease and dirt, and to provide "toothage" for adhesion of the first coat of paint. Then, three coats of paint are applied. The first two are flowed on to assure complete coverage. The third, finish coat, is sprayed.

Freon gas test okays all seams

Gasketed and welded joints are checked with the highly reliable freon gas leak detection test. The transformer is placed under positive gas pressure with a charge of freon gas. If *any* gas leaks through the joints of tank, cover, or bushings, it is drawn into the electronic "sniffer gun" to an electronic detector circuit that actuates an alarm. If a leak is detected, the faulty seal is corrected and retested.

"Low-Set" valve drains entire tank

Intermediate-size Pole Star transformers are now equipped with the Pennsylvania "low-set" power transformer drain valve. Now, it is no longer necessary to tip the transformer or apply internal pressure to completely drain the tank. As a result, there will be no mixture of old and new oil—a precaution that can pay off in additional years of trouble-free service.

Controlled tube production pays off in quality

To maintain consistently high quality, the entire production of cooling tubes and radiators is handled in Pennsylvania's own plant. Facilities include a modern electric-weld-tube mill. Details such as the welding coolant, seam quality, and storage procedure are under constant surveillance. Rigid control in the production of this important transformer component makes a difference as the years of service begin to add up.

Rugged base makes maintenance easier

Welded solidly to the tank, the base of intermediate Pole Stars has four large openings for ventilation, to prevent condensation on the tank bottom. These openings also facilitate cleaning and painting in the field. To facilitate jacking, base jacklugs extend either between or beyond tubes and radiators. The transformer can be rolled in any direction.

externally, too . . . you get power transformer ruggedness with intermediate

PENNSYLVANIA POLE STAR DISTRIBUTION TRANSFORMERS

250 through 500 kva

a product of

Pennsylvania Transformer Division

McGRAW-EDISON COMPANY

Canonsburg, Pennsylvania

McGRAW EDISON

POLE STAR

A message from General Electric to help your load-building promotion program

Many utilities are now planning long-range load growth programs—and greater utilization of existing capacity. More and more utilities are incorporating in their plans active promotion of electric heating and cooling—in *commercial*, *industrial* and *residential* applications. General Electric Weathertron offers to share the benefit of its vast experience gained from closely co-ordinated programming with utilities successfully building greater electric heating and cooling loads.

As a starter, we'll welcome the opportunity of sending you the new General Electric Weathertron Heat Pump guide in the form of a promotion calendar.

This easy-to-use guide is filled with useful ideas that will simplify the planning of your entire year's heat pump promotion activity, will help you plan more effectively. It's yours for the asking. Write Mr. Paul O'Neill, General Electric Company, Air Conditioning Department, 5 Lawrence St., Bloomfield, N. J.

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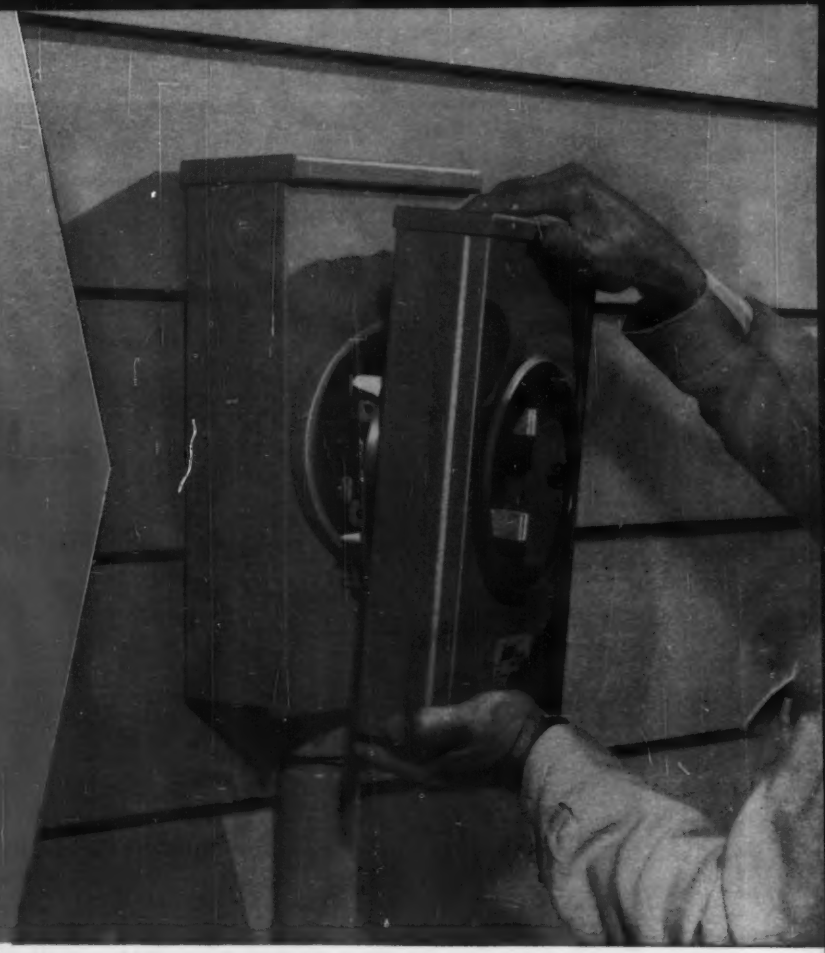
ALL-ELECTRIC HEAT PUMP

Progress Is Our Most Important Product

GENERAL ELECTRIC

BEAT THE SUMMER HEAT STORMS!



add low cost vars at point of greatest system benefit with SANGAMO SECOVAR Secondary Capacitors

The critical summer peak load is coming up fast! And with it comes the nightmare of overloaded distribution transformers and emergency changeouts.

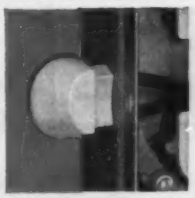
You can avoid replacing overloaded equipment in most cases by permanently installing Sangamo Secovar Secondary Capacitors right at the meter box on your customer's premises. These 240 volt capacitors can be installed by one man—give maximum system benefits all down the line . . . from the service drop to the secondaries . . . to the distribution transformer . . . to the power transformer . . . to the generator.

They provide a quick and easy solution to the problem of unloading hot distribution transformers. Secovar Capacitors are available in two types: Type S, a 2 kvar unit for socket mounting; and Type N, a 1 kvar unit for adjacent mounting. Bulletin 1131 gives full information.

SANGAMO ELECTRIC COMPANY, Springfield, Illinois

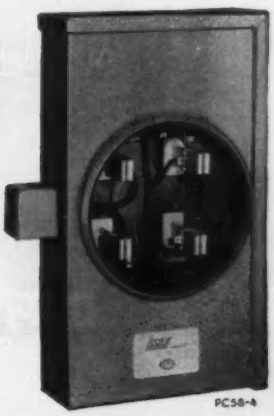
ONE MAN INSTALLATION

1. Plug Secovar unit into meter socket and install sealing ring.
2. Install watthour meter in Secovar socket.
3. Installation is complete—ready to supply vars to your system.



OPTIONAL THERMOSTATIC SWITCH

Automatically switches capacitor in and out on predetermined ambient temperatures. Standard range is on at 85° F.—off at 75° F.



PC58-4

Announcing

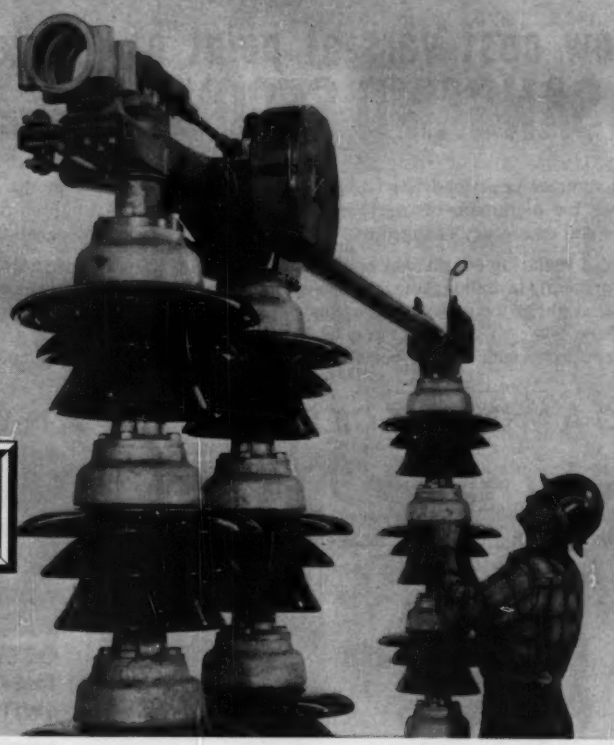
The HM50 SWITCH

A modern high voltage disconnect . . . from 69 HKV to 230 KV

Here is the answer for the system engineer who wants a switch designed to meet the severe demands of modern high voltage systems . . . requirements that can no longer be met by beefing up old designs.

The HM50 is completely new. We believe it marks a definite advance beyond the switchgear presently offered. The utmost capacity of its contact system is not yet known—it continued to function efficiently at the extreme output of the testing facility—over 120,000 amperes.

Some of the major features of the HM50 are: a completely controllable rotating blade; multiple finger contacts and a triple locking system that insures protection during short circuits. It is easy to operate, maintenance free and able to stand the degree of momentary surge possible with today's interlocking systems.

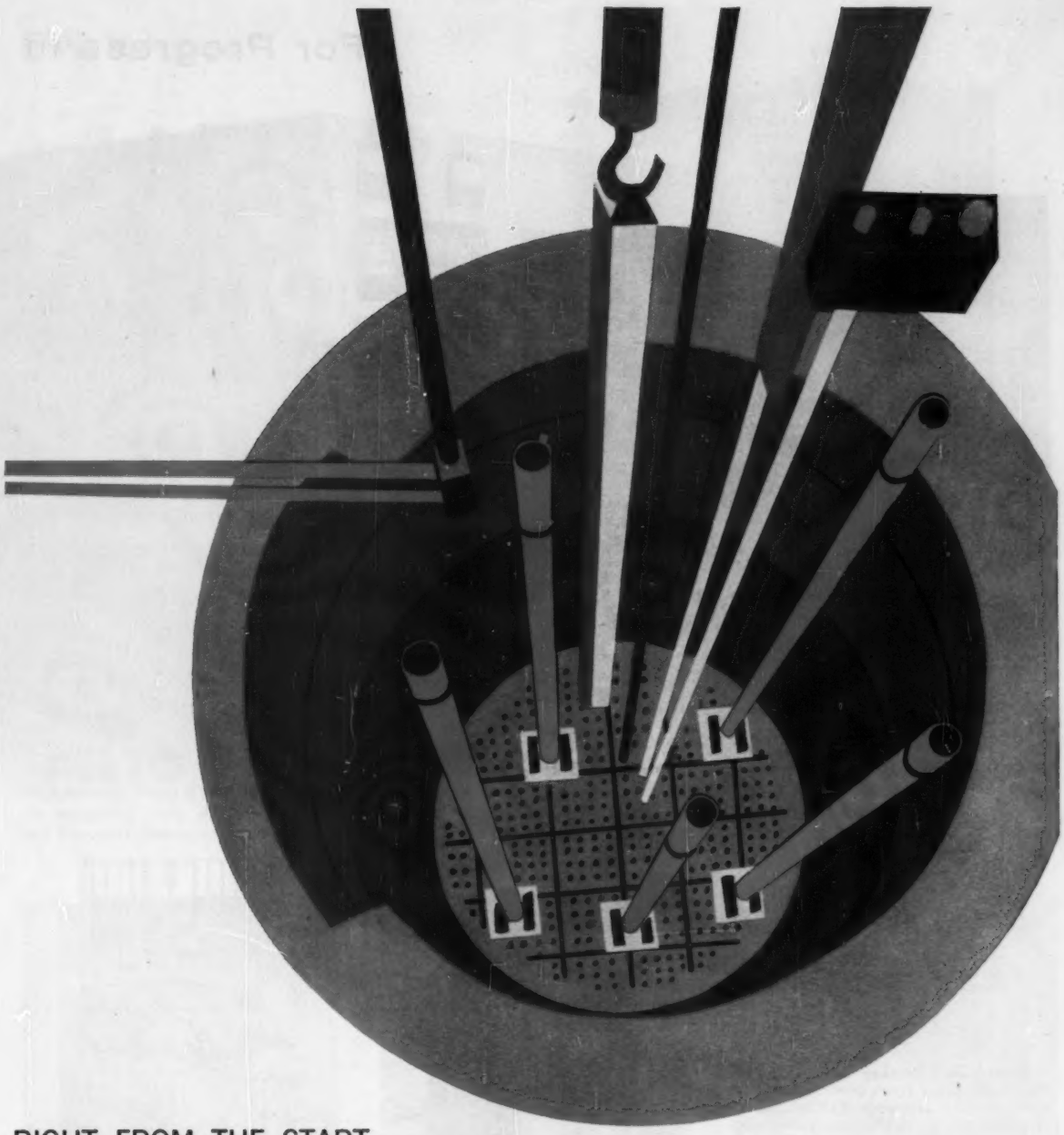


If you have not yet seen a full description of the HM50 . . . Write us for Bulletin 334.

3E

ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park, Illinois

Representatives in principal cities



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When piping costs come close to the million mark — when the installation is vast, and the leeway for error is small — a piping job must be right from the start to finish. Grinnell assures this through complete one-company control and responsibility. From interpretive engineering — through exclusive methods of prefabrication and testing of pipe and hanger units — to precision assembly and delivery, the job is all done by Grinnell, as only Grinnell can do it. The result: installations of any size, at costs known before you start, with assured performance. Grinnell Company, Inc., Providence, R.I.

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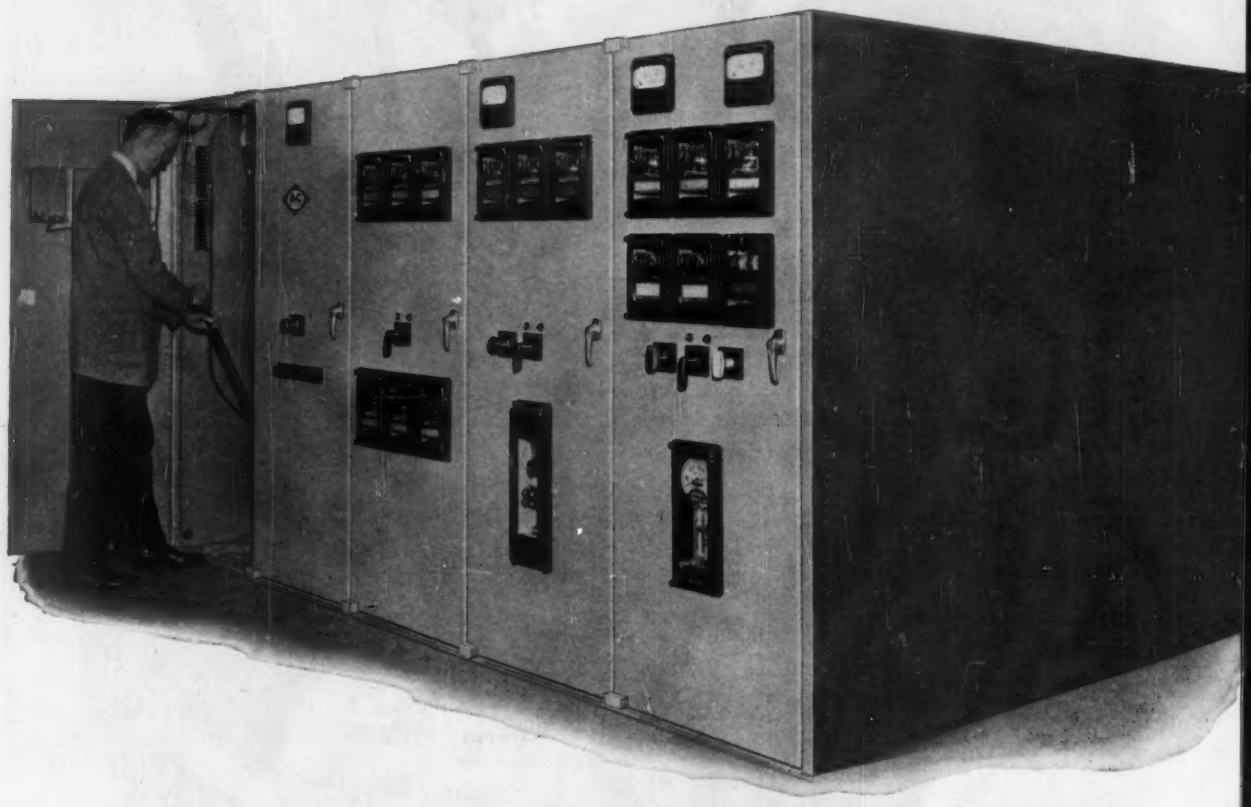
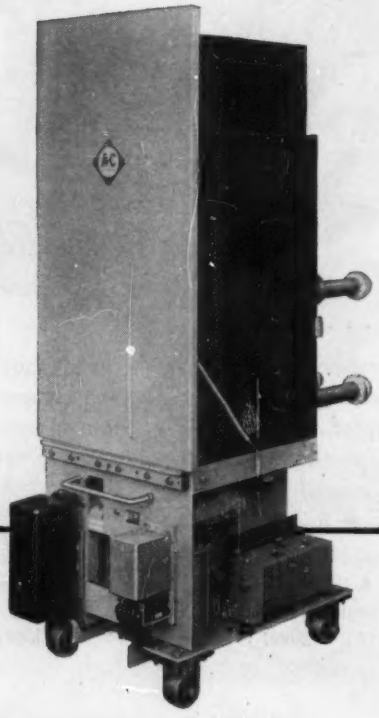
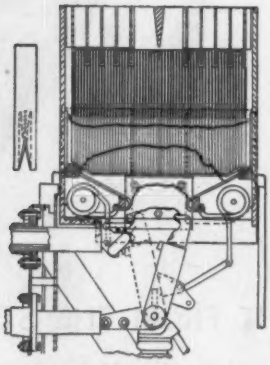
GRINNELL

For Progress in





Self-contained breaker control . . . removing breaker from unit removes all cooperating elements for testing to simulate service conditions. Automatic-locking steel barrier provides maximum protection with double steel walls between operator and interrupter.



Horizontal contact separation takes full advantage of thermal effect of arc. Two blowout coils per phase produce magnetic field for fast arc extinction. Puffers accelerate low current interruption.

ALLIS-

Switchgear

NEW

low silhouette ...new advances

Allis-Chalmers 4.16 kv horizontal-drawout metal-clad switchgear offers latest convenience, safety and engineering advances

Let's start with the new 72-inch silhouette — the lowest in the industry. It means eye-level instrumentation plus shoulder-height accessibility of auxiliary equipment. The Allis-Chalmers "new" look is the right look with the right approach to operating problems.

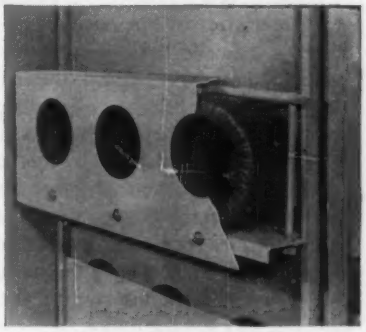
Maximum Compartmentation — This new Allis-Chalmers switchgear is the most completely compartmented switchgear available. Current transformers can be mounted on bus or load side in standard unit. All circuits are segregated . . . all live parts are completely enclosed . . . all metal barriers are grounded. Full interlocking further insures operator safety.

Quick "one-stroke" insertion of *Ruptair* breakers takes less than 15 seconds from the fully disconnected to the connected position. The *Ruptair* breaker is available for all applications — 2 or 5 cycle operation, 75, 150, 250 or 350 mva, and 1200, 2000, or 3000 amperes continuous.

Get Literature — Contact your nearby Allis-Chalmers office for further information, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

It takes less than a minute to install a molded glass polyester cover over a bus joint to join shipping groups in the field. No taping, no messy compounds . . . another exclusive feature.

There's shoulder height accessibility of potential transformers whether mounted in top rear of standard unit or auxiliary unit. Three cast epoxy resin PT's may be mounted on one safe tilt-out carriage.



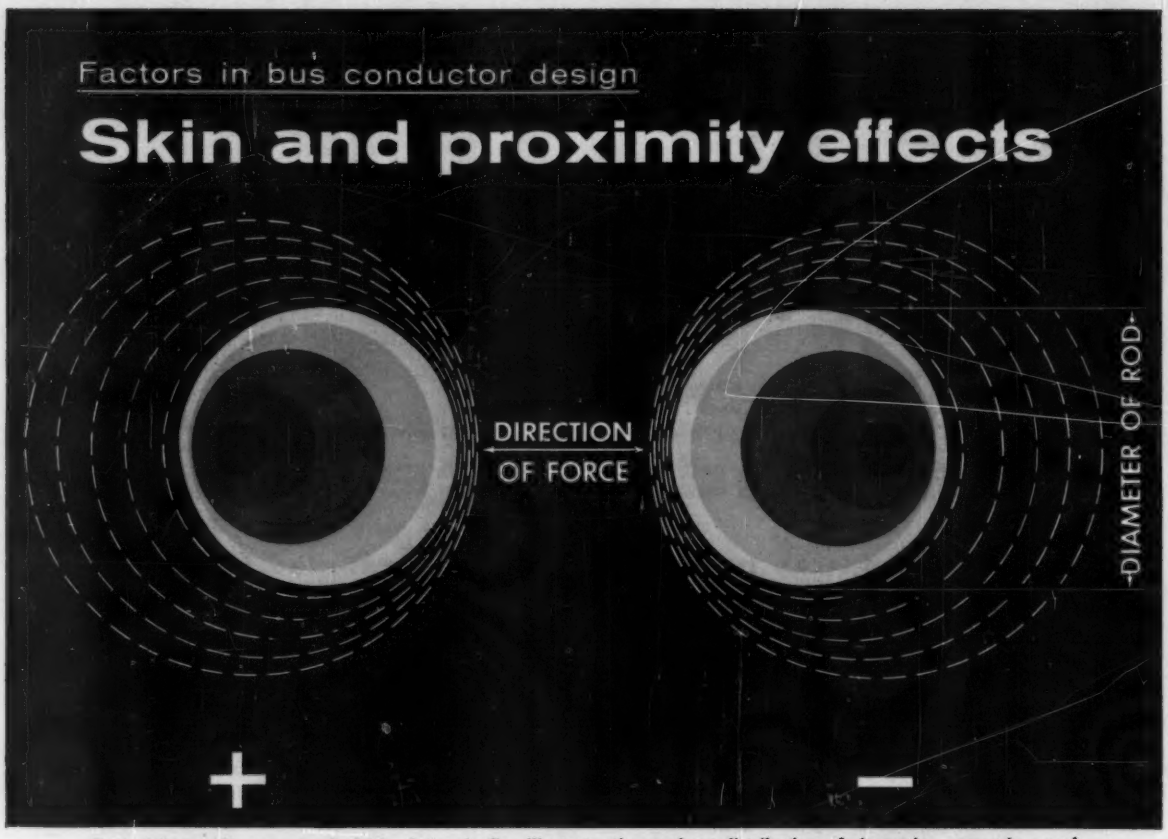
Location of transformers behind grounded metal barrier in breaker compartment in front of automatic shutters provides maximum operator safety for test and replacement.

CHALMERS A-C ALLIS-CHALMERS A-5777

Ruptair is an Allis-Chalmers trademark.

Factors in bus conductor design

Skin and proximity effects



Dotted lines indicate magnetic fields. Color shading illustrates the resultant distribution of alternating current in round rod conductors. Mechanical force is developed as the centers of current try to move into the centers of their magnetic fields.

Low skin-effect ratio favors tubular shape

Skin effect becomes increasingly important in the medium and larger sizes of bus conductors carrying alternating current. It is the basic reason for using tubular conductors, quite apart from the structural advantages which they also possess. Tubular shapes (round or square) and paired channels have low skin-effect ratios, i.e., low effective resistance to alternating current.

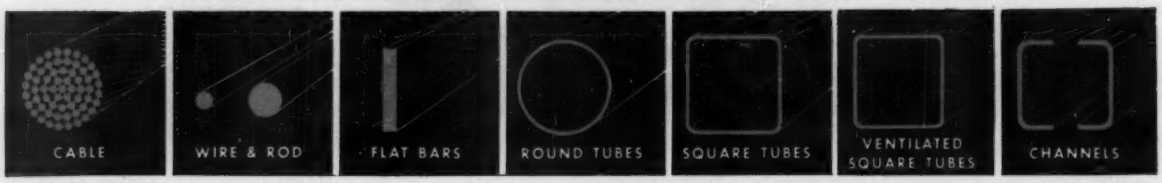
Skin effect is, essentially, the crowding of the main alternating current flowing in a conductor toward the outside surface by a contrary flow induced in the center of a solid conductor, a cable, or in the inner annular area of a tubular conductor by the constantly varying magnetic flux surrounding it.

Proximity effect is uneven distribution of an electrical current over the cross-section of a conductor due to distortion of the surrounding magnetic field by the field or fields generated by current in neighboring conductors. The practical result of "proximity" is an increase in the apparent resistances of the conductors affected. Mechanical forces also are generated.

Field-and-current distribution problems are two of the many which complicate bus design. The Technical Department of The American Brass Company is always available to engineers for consultation in the selection of Bus Conductors for specific needs. To arrange for consultation and to obtain a copy of Publication C-25, Anaconda Copper for Electrical Conductors, see your Anaconda representative, or address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 8799 Rev.

ANACONDA® COPPER CONDUCTORS

THERE'S AN ANACONDA ELECTRICAL CONDUCTOR FOR EVERY NEED



The Electrical Week

FUTURE NEWS ▶ **Senate Public Works Committee will hold final hearings soon** on the Frank Welch TVA nomination. Approval is expected.

LATE NEWS ▶ **At AIEE's Summer General Meeting in Buffalo last week:**

- **L. F. Hickernell was elected AIEE pres for 1958-59.** Hickernell is vice president—engineering of Anaconda Wire & Cable Co.
- **Also elected** were seven vp's: L. C. Holmes, Stromberg-Carlson Co, J. R. Kerner and I. T. Monseth, Westinghouse; R. B. Gear, Commonwealth Ed; J. M. Nelson, Seattle City Light; and W. H. Chase, Ohio Bell Tel; C. H. Linder, GE, is new treasurer.
- **AIEE conferred honorary membership on D. A. Quarles,** deputy secretary of defense, and gave the 1957 Lamme Medalist Award to Harold S. Black of Bell Telephone Lab.
- **The building fund,** said retiring AIEE President Walter Barrett, is proceeding "actively."

Bonneville Power Authority's load, as of June 1, was down 28% below a year ago, according to figures just released by the agency.

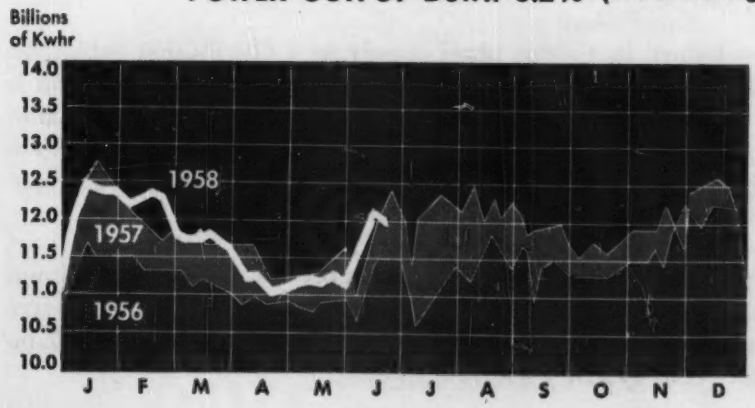
Westinghouse Electric picks site for power transformer plant in Muncie, Ind. It will be operating late 1961 or early '62.

U. S. Supreme Court reverses a Washington State Supreme Court decision upholding state's claim that Tacoma Dept of Public Utilities lacked power to condemn state lands for the proposed $146 million hydro project on the Cowlitz River.

Management changes . . . F. J. Herr becomes VP of Central & South West Corp. . . . A. H. Herbert advances to VP and general manager and H. Carpenter to VP, chief engr of Minnesota P&L.

Obituary . . . William V. O'Brien, 57, vp and general manager of GE's Apparatus Sales Division died on June 21 in Scarsdale, N. Y.

POWER OUTPUT—Down 3.2% (Week ending June 21), Kwhr 11,941,000,000



Per Cent Change From Previous Year

	June 7	June 14	June 21
Total U. S.	+1.1	+1.3	−3.2
New Eng.	−0.5	−0.4	−4.4
Mid. Atlantic ..	−1.3	−1.2	−10.5
Cent. Ind.	−2.8	−1.8	−6.7
West Cent.	+4.3	+4.4	+0.3
Southeast	−0.1	+2.0	−2.4
South Cent. ...	+25.1	+14.0	+12.5
Rocky Mount. ..	+8.1	+6.8	+5.1
Pacific			
NW	−9.8	−10.5	−11.9
SW	−0.4	+3.3	+2.1

Seasonally Adjusted Index 223.9

Week Ago 232.1 Year Ago 233.0

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World Estimate). Excluding AEC, Output decrease was 2.8%.

A TWO-MINUTE PREVIEW OF THIS ISSUE

EVENTS ▶ **Electric heating—the keystone of the all-electric home—is** the only way the electric utilities will ever break the "kilowatt-hour barrier" they are now facing. Such was the theme at Electrical World's Third Electric Space Heating and Heat Pump Conference, June 5-6, as outlined on p 41.

Washington is giving power matters a rest, as Congressional eyes are focused on other woes—Sputniks, the recession, and foreign policy, to name a few. The skirmishing between private and public power advocates still goes on, with neither side making any earth-shaking gains in an atmosphere of comparative quiet. Undoubtedly, the coming elections and the lateness of this session have something to do with it (p 36).

Increased revenues to the tune of $28 million annually have been made possible for two utilities in recent rate cases (p 38).

AEC power purchases slumped 1.9% to 56.6 billion kwhr in 1957. Full story, complete AEC power utilization by plants (p 38).

GENERATION ▶ **New England Power Service Co has extended its precedent setting** ground-fault neutralizing scheme to its generator No. 3 at Salem Harbor Station. Installation of a cable system rather than isolated phase bus duct for generator leads is expected to save $123,000 (p 50).

TRANSMISSION ▶ **Forces on spacers due to short circuits** in twin conductor transmission lines have been determined by Detroit Edison—nearly 500 lbs at 19,000 symmetrical amps (p 45).

DISTRIBUTION ▶ **Ebasco engineer proposes alternative** to the higher distribution voltage most favored by utility engineers, and presents the pros and cons for three most likely voltage levels (p 46).

System load-growth curves without "bumps" aid analysis of economic factors, are yours for the asking according to Portland Electric Co, whose degree-day normalizing technique irons out temperature deviations (p 49).

SUBSTATIONS ▶ **Phase failure in a three phase supply** to a distribution substation threatens damage to three phase motor loads. The ideal solution is offered by Idaho Power Co, whose new and inexpensive approach to the phase reversal problem is a phase failure relay built almost entirely from commercial parts. Thus far 24 have been installed in substations serving deepwell irrigation pumps (p 47).

Almost before you can say "Alrectric", a pre-fabricated, all aluminum substation can be raised. Whole job takes six hrs. Learn how to save on installation costs and through the long haul with minimum maintenance costs (p 51).

MANAGEMENT ▶ **American youngsters are learning about free enterprise** through Junior Achievement: A program of business education which lets them organize, finance and run their own firms under supervision of experienced businessmen. Electric utilities play an important role in the program, backing more than 100 Junior Achievement companies with products ranging from bookends to transistor radios. Here's how JA works, and a roundup of the electric utilities' participation in the program (p 71).

MEETINGS ▶ **Helicopter "skyhooks" for rough country line construction,** low cost residential underground distribution, storm tracking and latest hints on distribution economies were but a few of the topics for discussion by EEI's Transmission and Distribution Committee last month. Recapitulation on p 57.

RIGHTS OF WAY ▶ **The postman handles routine right of way problems** for Detroit Edison Co. Utility finds 50% of its mailed contracts are being returned, cutting in half the number of field contacts required to complete the job (p 40).

SELLING ▶ **Atlantic Refining Co cooks grease** in its new 1,500 gal electric kettle; unit has four 55 kw heaters, boasts 20% greater efficiency than fuel fired units . . . Lack of central heating is no longer a problem for a St. Louis plant, where five 1,100 watt heaters can be moved about to keep workers cozy in winter (p 78).

MANUFACTURERS ▶ **Friction, number one bugaboo of modern instrument design,** has been virtually eliminated in Westinghouse Electric's new pivotless, bearingless instrument construction. Minute filaments support rotating parts, opening up whole new ranges of instrument response . . . Watch for the Square "D" caravan soon to tour, demonstrate company wares in 100 US cities . . . GE's newest turbine generator features water cooled stator windings, is now under construction. Using this scheme company sets sights on 1,000 Mva unit (p 59).

NEW EQUIPMENT ▶ **Torsion bar suspended cable reel trailer protects its cargo,** eliminates trailer bounce and absorbs jolts which could speed deterioration of trailer. One man loads, handles, up to twelve ton reel . . . Speedy pinpointing of off-normal equipment is assured with new recording annunciator; monitors operation of remote or attended power stations (p 67).

PEOPLE ▶ **Con Edison of NY ups** Bernard E. Gallagher and Gerald R. Hadden to vice president; Charles W. Franklin and Gordon R. Milne are new chief electrical and mechanical engineers, respectively . . . At Jersey Central Power & Light Co and New Jersey Power & Light Co, William H. McElwain advances to executive vice president . . . William B. Waterman is now vice president and general counsel for Iowa-Illinois Gas & Electric Co (p 80).

Another false doctrine which has bedeviled the industry is that capital attraction should be the test for setting the allowable rate of return. Capital can always be attracted at a price, however unfair and uneconomical that price may be to the existing investors. In the electric utility industry, under the original cost accounting concept of regulation, new capital is being attracted by the simple process of distributing the equity of the old investors. In other words, capital is being distributed as income. Thus confiscation of property is the end result of original cost accounting.—**C. P. Guercken, Public Utilities Fortnightly, June 5, 1958.**

Solid and liquid poisons, moderator, and fuel dumping are being considered and used as safety systems in the event of reactor excursions. The goal is to achieve simpler, more reliable systems than conventional safety rods.—**N. E. Huston, N. C. Miller, Nucleonics, May 1958.**

TECHNICAL NOTES

A deionizing time of 0.3 sec should be ample when switching 330-kv lines up to 150 miles in length and 0.5 sec may be ample for 270 miles.

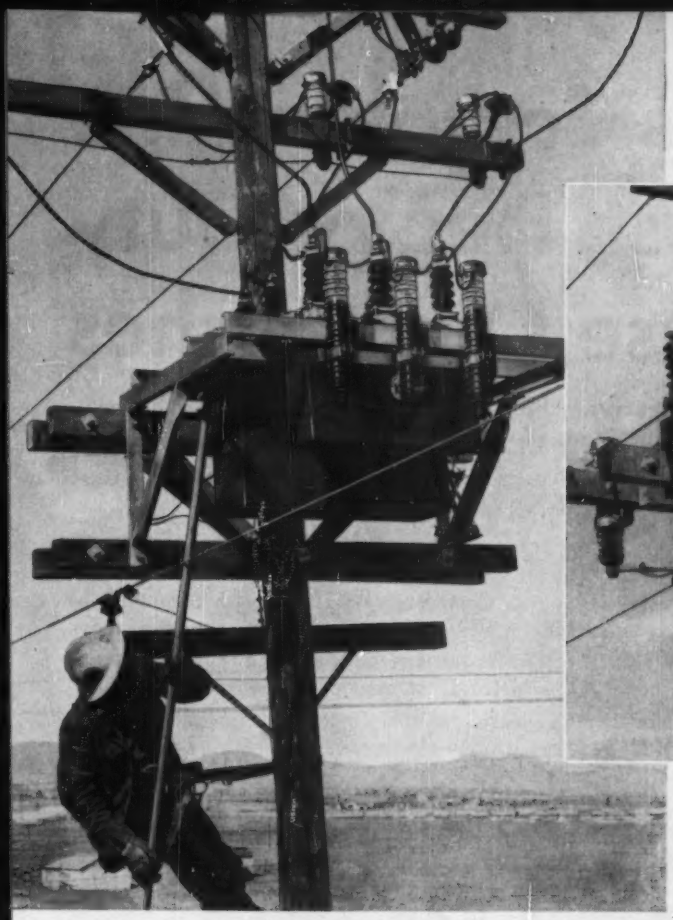
Energy loss in the skin quickly produces blisters and current increases to a dangerous value when a shock victim is frozen to a circuit. The current sufficient to freeze a person to a circuit by causing muscular contraction exceeds 6 ma for women and 9 ma for men.

Removal of burst fuel elements in nuclear reactors is important not only because unwanted fission products will contaminate the reactor system but also because they will reduce the sensitivity of the detection equipment and prevent, or at least, delay, the detection of other defective elements.

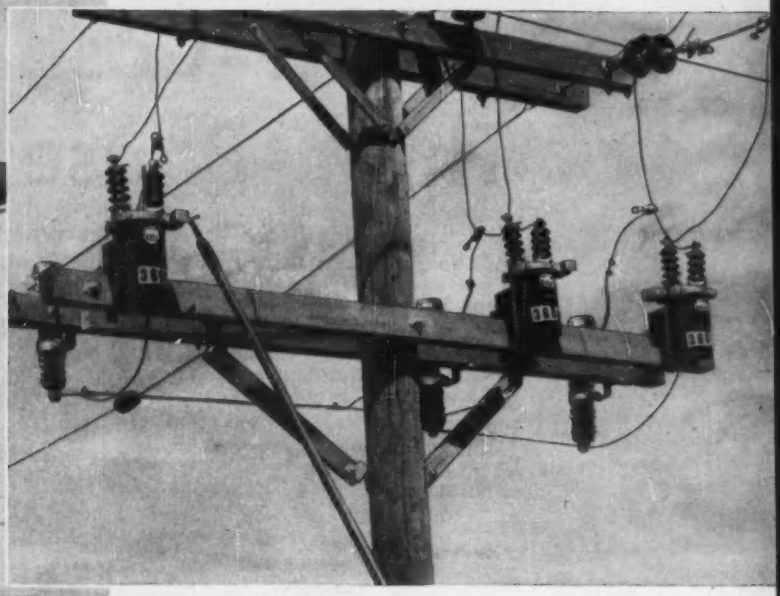
FROM EDITORS IN THE FIELD

About 35,000 electric vehicles were in operation in Great Britain by the end of 1957. Most of them are used by industry and there are indications that their acceptance will be accelerated

Turbines are now being inspected internally every six years by Gulf States Utilities Co. Cost of internal inspection is about 75¢ per kw, not including major parts.



THREE-PHASE 185-ampere Kyle Type R recloser with 200-ampere ground tripping protects the main circuit from faults on a 3-phase branch line in Denver.



THREE 140-AMPERE single-phase Kyle sectionalizers protect the main feeder from faults on short branch lines, and also sectionalize areas behind reclosers. These are operated either by recloser or station breaker.

Report From Public Service Company of Colorado...

Standard Recloser Application Program Conserves Time For Utility's Engineers

Fundamental plan simplifies application of reclosers and sectionalizers; conserves engineering, record-keeping, and storekeeping time; gives better conductor protection.

A standard application plan for reclosers and sectionalizers offers many advantages. With a predetermined program, this equipment is selected and installed according to the plan, without any further engineering.

Basically the plan consists of selecting certain ratings of reclosers and sectionalizers to be applied to branches according to load, line length, and exposure. The plan automatically assures adequate protection against burndowns, gives better assurance of service continuity, and insures coordination.

Public Service Company of Colorado is an outstanding example of a utility with a fundamental protection plan. According to Messrs. Hayden, Martin, and Tilson, electrical engineers for P.S. Company, in the first year "savings in engineering time, record-keeping, and storekeeping have been so obvious as to warrant considerable enthusiasm. Also field experience so far has been most gratifying, because it has indicated that definite and concrete operating benefits have been and will continue to be enjoyed as a result of this plan."

This and other programs provide for complete flexibility. In the original program, any ratings and sequences that engineering prefers are selected. Thereafter the plan is applied automatically. The plan provides for switching or dividing load areas or feeders, and for taking care of increasing loads.

Ask Us For Details

Bulletins on Kyle Reclosers and a copy of a paper on the Colorado plan are available. We'll be glad to supply you with copies. Ask the L-M Field Engineer, or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

McGRAW EDISON

LINE MATERIAL Industries Kyle® Reclosers

McGRAW-EDISON COMPANY

337

Only L-M Offers Complete Line of Low-Cost, Heavy-Duty Three-Phase Oil Switches

Now all types of loads—capacitive or inductive—can be switched economically with manual or remote operation, using one of the Kyle "V" family of three-phase oil switches.

Three Types of Switches

L-M's Kyle "V" family consists of three basic types of switches:

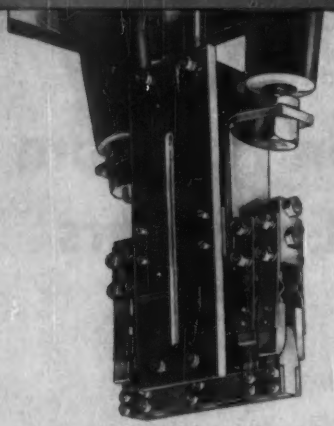
1. One for general-purpose switching, such as single-step capacitor switching and automatic transfer of normal power-factor loads.

2. One for automatic transfer and tie schemes involving loads having low lagging power-factor currents, such as unloaded motors.

3. One designed specifically to withstand the severe duty imposed by step-switching capacitors.

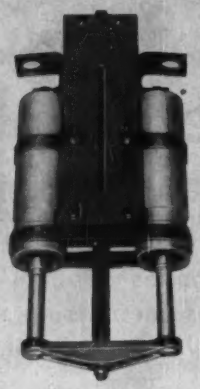
These switches have a maximum design voltage of 15.5 kv, a momentary rating and latching rating of 20,000 amperes (asymmetric), and a four-second rating of 6,000 amperes (symmetric).

All three switches are available with motor-driven actuator assembly for remote electrical operation. The general-duty (1) and inductive-current (2) switches are also available for hook stick operation, or with remote manual linkage for operation from base of pole.



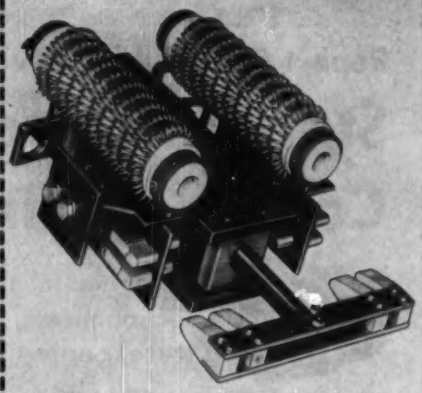
GENERAL DUTY CONTACT ASSEMBLY

Copper-tungsten arcing contacts absorb the punishment of switching, keeping erosion on load contacts at a minimum.



INDUCTIVE CURRENT CONTACT ASSEMBLY

Interrupting tubes assure minimum arcing time during load-current interruption, thus enabling the switch to handle currents with power factor as low as 10% lagging.



STEP CAPACITOR CONTACT ASSEMBLY

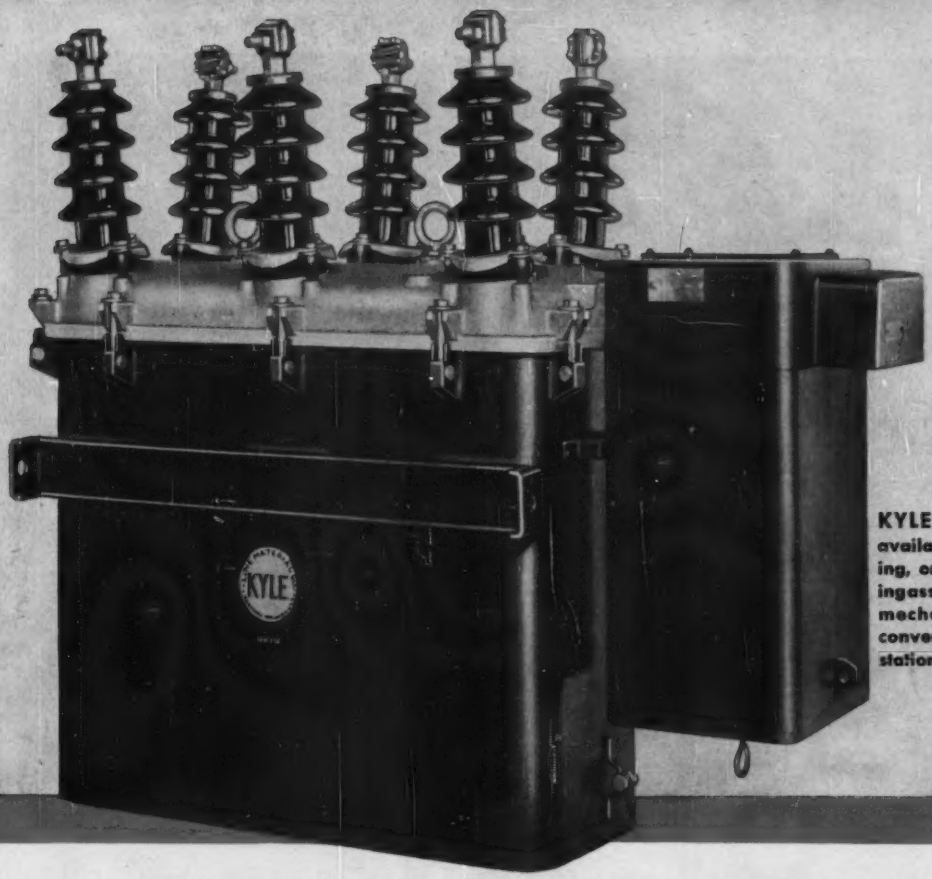
7½ ohms of resistance in series with arcing contacts limits the high-frequency transient inrush to values within the short-time capability of the switch.

Get More Complete Information

L-M offers the most complete line of oil switches and accessories for manual and automatic load transfer and switching schemes. Ask your L-M Field Engineer for information and bulletins. Or write Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL Industries

McGRAW-EDISON COMPANY



KYLE "V" SWITCHES are available for crossarm mounting, or with substation mounting assembly, including hoisting mechanism, to provide for convenient and versatile substation installation.

KYLE® Heavy-Duty, Three-Phase Oil Switches 400 Amp. 110 kv BIL

2.4 kv through 14.4 kv • Maximum design voltage 15.5 kv • Momentary rating 20,000 amps (asymmetric) • Four-second rating 6,000 amps (symmetric)

	SWITCHING RATINGS	TYPES	PRICE	APPLICATIONS
General Duty Switch	**7.2 kv through 14.4 kv** 75-100% p.f. 200 amps rms 40-75 % p.f. 100 amps rms 10-50 % p.f. 50 amps rms **2.4 kv through 7.2 kv** 75-100% p.f. 400 amps rms 50-75 % p.f. 200 amps rms 10-50 % p.f. 100 amps rms	**Hook Stick Operation** **Remote Electrical Operation** **Remote Manual Operation**	**VH $625** **VR $885** **VM $710**	Manual sectionalizing switches. Automatic transfer schemes for duplicate service, feeder switching, bus transfer switching, bus ties. Single-step capacitor switching.
Inductive Current Switch	Switches are capable of switching their full continuous rating, 400 amps from unity power-factor down to 10% lagging power-factor.	**Hook Stick Operation** **Remote Electrical Operation** **Remote Manual Operation**	**VLH $655** **VLR $915** **VLM $740**	Automatic transfer and tie schemes involving low lagging power-factor currents.
Step Capacitor Switch	Nominal capacitor switching current 300 amperes	**Remote Electrical Operation**	**VCR $1055**	Designed specifically to withstand the severe duty imposed by multi-step switching of capacitor banks.

The Kyle Type VR, VLR and VCR switches are equipped with motor-operated actuator mechanisms to make possible remote electrical operation. Such remote operation can be initiated either by push button or through current, voltage, time-sensitive, or other relay scheme.

ACCESSORIES

Available on VR, VLR, and VCR.

A 1, 2, 3, or 4-stage auxiliary switch can be factory installed for use when the VR switch is used with relay or interlocking schemes or switchboard position indication.

Low-voltage arresters can be installed within the actuator housing.

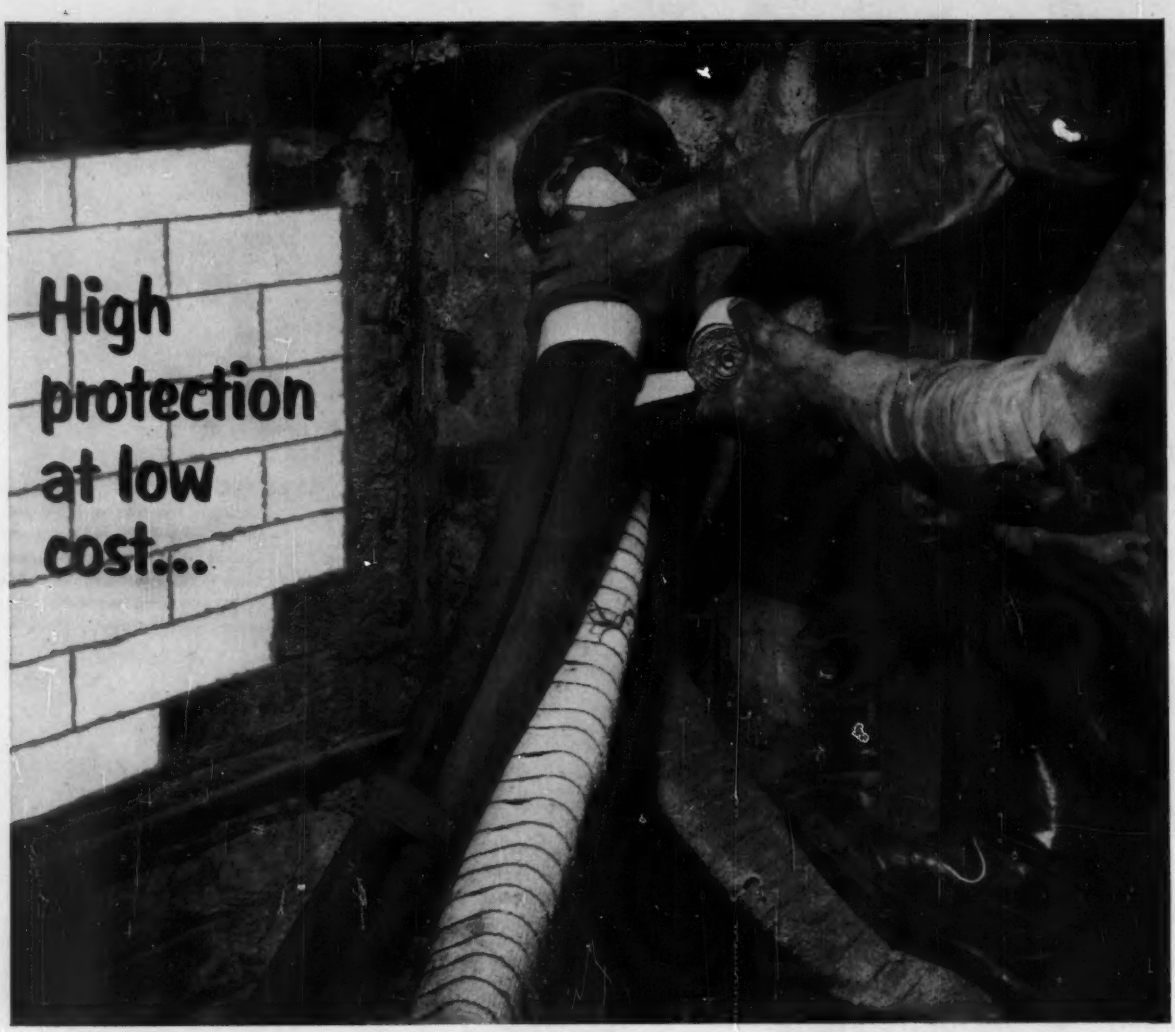
Heating element can be installed in the actuator housing when application is in unusually damp, foggy, or humid atmospheres.

15" and 17" creepage distance bushings are available for the entire family of switches.

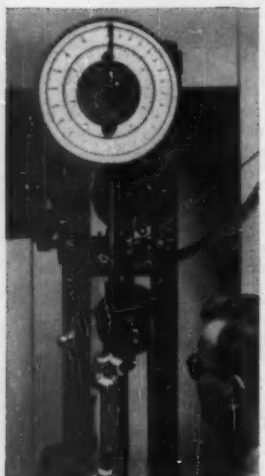
Kyle® Oil Switches

333

McGRAW EDISON



J-M No. 55 Cable Fireproofing Tape helps contain blowouts—isolate trouble



Scott Tensile Strength Tester proves J-M No. 55 Cable Fireproofing Tape maintains its high strength even after burnout.

Reduce the danger of arc multiplying your troubles in the event of cable failure. Repeated tests prove Johns-Manville No. 55 Tape helps contain arc and splash . . . and retains substantial strength even after being burnt out!

Leading public utilities have chosen J-M No. 55 for its long-range economy plus its dependability. In addition to exceeding their protection requirements, it saves time and money because it costs less to apply. It goes on faster because it's applied *dry*, wraps easily even in confined spaces.

J-M No. 55 protects cables for years under manhole conditions because of top quality asbestos construction and thorough impregnation with silicone. Produced by J-M in an economical thickness, it is high in water repellence, low in water absorption . . . resistant to flame, heat, oil, fungus and mold . . . nonsagging . . . abrasive resistant. The selvaged edges keep ground water out . . . and threads cannot pull out.

For complete details, and test data on J-M No. 55 Cable Fireproofing Tape, write for new brochure TX-6A. Address, Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

JOHNS-MANVILLE

100 YEARS OF QUALITY PRODUCTS...1858-1958

JM PRODUCTS

new symmetrical interrupting ratings for XS Cutouts adjust lab results to field conditions

S&C matches actual ratings to system short-circuit calculations

To simplify application, S&C has now provided symmetrical ratings for its distribution cutouts.

These new symmetrical ratings are provided because asymmetrical ratings are based on total available short-circuit current of the circuit, including the DC component. The asymmetrical ratings furnish a uniform, standardized measure of cutout performance, but they cannot, of course, be used directly in matching cutouts to system short-circuit calculations which yield *symmetrical* values.

The new symmetrical ratings bridge the gap and eliminate the possibility of "underprotecting" the system with a cutout of inadequate interrupting capacity, or "overprotecting" with a cutout of unnecessarily high interrupting capacity.

To arrive at a nominal set of symmetrical ratings, specific X/R ratios are assumed for the Heavy Duty XS and the Extra Heavy Duty XS,—8 and 12 respectively—typical of the conditions at locations where each of these cutouts is applied (see table at right).

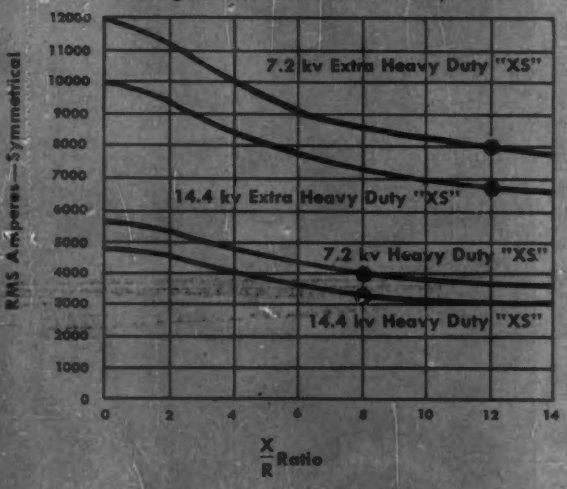
To enable the distribution engineer to take advantage of more favorable conditions—that is, where the X/R may be lower—special adjustment curves (shown to the right) are provided. These curves indicate the symmetrical interrupting ratings of the XS at other X/R ratios. (Those at 0 are the *actual* asymmetrical interrupting capacities of the XS, which may differ from the *nominal* asymmetrical ratings per NEMA standards.)

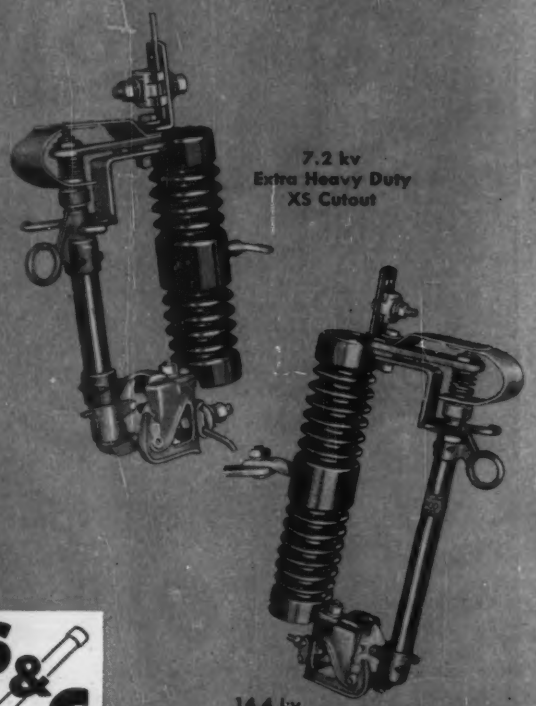
For further information, write for Descriptive Bulletin 511—providing full data on the XS Cutout—to S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

50/60 Cycle Short-Circuit "Nominal" Interrupting Ratings

Nominal Ratings kv	Amperes, RMS			
	Heavy Duty "XS"		Extra Heavy Duty "XS"	
	Asymmetrical	Symmetrical	Asymmetrical	Symmetrical
7.2	5000	4000	12000	8000
14.4	4000	3300	10000	6700

Adjustment Curves for Symmetrical Interrupting Ratings of XS Cutouts at various X/R Ratios.





7.2 kv Extra Heavy Duty XS Cutout

14.4 kv Heavy Duty XS Cutout

S&C ELECTRIC COMPANY

Power Fuses · Tool-Operated Disconnects · Open and Enclosed Cutouts · Load Interrupters · Metalclad Switchgear · "Loadbuster"

S&C

Plowback of earnings into research and development provides new approach to economics of transformer loading . . .

NEW INSULDUR SYSTEM PROVIDES 10% MORE FOR ALL WESTINGHOUSE

PROTECTS INSULATION, OVERLOAD CAPABILITY POWER TRANSFORMERS

Now used in all new Westinghouse power transformers, the Insuldur* system significantly retards the deterioration of transformer insulation. This system, another product of continuing research and development, utilizes an amine stabilizing compound which gives insulation the ability to withstand higher operating temperatures.

Regardless of the overload practice you may follow, Westinghouse transformers protected by the Insuldur system can carry more overload than any other transformer without the Insuldur system—with no additional loss of insulation life.

Thus, the Insuldur system in Westinghouse power transformers is your means of obtaining more overload—economically. For instance, if you can economically justify overloading a conventional transformer 125% for 24 hours, a Westinghouse power transformer with the Insuldur system can be overloaded 135% for the same time—*with no greater loss of insulation life.*

Ask your Westinghouse representative about the Insuldur system for power transformers . . . and the "Crumble Test" proof of added insulation strength.

J-70885

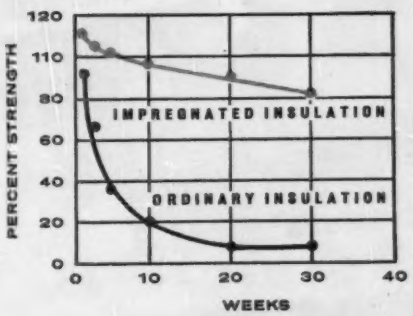
*Trade-Mark

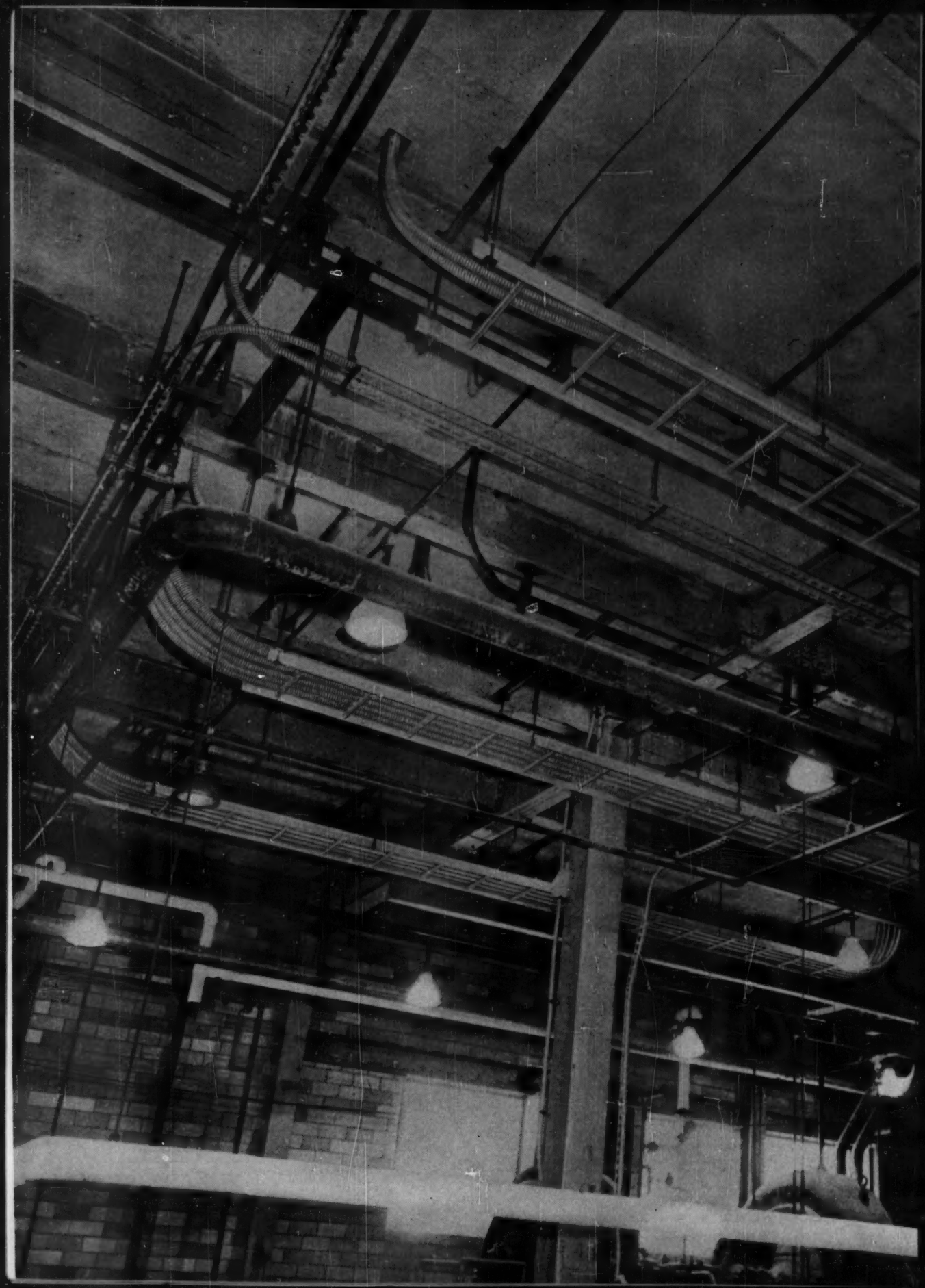
YOU CAN BE SURE...IF IT'S **Westinghouse**

The "Crumble Test" demonstrates superior heat-aging resistance of Westinghouse Insuldur-system insulation . . . proves that overload conditions endanger the insulation life of power transformers without the Insuldur system. Visual inspection (left) shows charred insulation not protected by the Insuldur system during overload tests. Insuldur-system insulation shows little change. Where ordinary insulation has "died" (right), Insuldur-system insulation has bounced back, full of life . . . providing safe extra overload capability.

◀ Bob McCollom, Manager, Westinghouse Power Transformer Department, points out that the overload capability added by the Insuldur system is now available in new Westinghouse power transformers.

Aging-rate curves of impregnated insulation and ordinary insulation prove Insuldur system's positive resistance to aging. After 30 weeks at 135°C, Insuldur-system insulation is 10 times stronger. ▶





this picture shows why . . .

Anaconda's Duralox Cable cuts installation costs for Electric Utilities

Duralox needs no conduit—saves time, money, man power . . . provides greater safety!

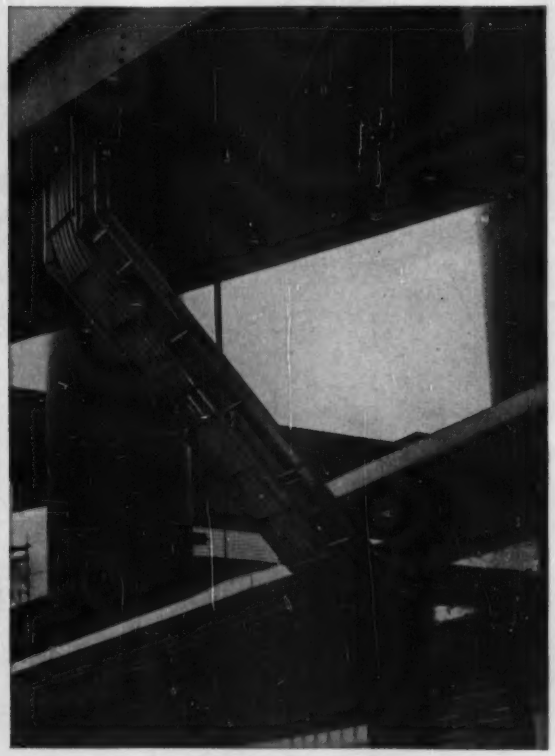
Duralox* is enclosed in its own durable, yet flexible metal armor. Thus, it can be installed *without* conduit—in long runs over and around obstructions, in racks, indoors or out. For one midwest utility this meant a savings of $5.00 per foot—over the cost of installing ordinary cable with rigid conduit!

Duralox is so flexible that additional flexible connections are not needed at motors. Duralox is easily moved—allowing for changes in design during construction or service, and facilitating repair work on other apparatus.

Because cables are always shielded, Duralox means greater safety.

And Duralox's lower reactance in higher voltages—from the close spacing of conductors—results in reduced voltage drop and more efficient power distribution. Anaconda Duralox Cable is available in all popular sizes and voltages—copper or aluminum conductors with paper, rubber, plastic or varnished-cloth insulation. Anaconda Duralox is also available for control circuits.

Why not talk to the Man from Anaconda about Duralox for your utility operation. See Anaconda in your telephone directory, in most principal cities.



FITTING NEATLY AROUND OBSTRUCTIONS. Anaconda Duralox Cable meant easy installation in utility's generating station.

BULLETIN DM5606 on Anaconda Duralox is yours for the asking. Write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Reg. U.S. Pat. Off. 58207

OUTSIDE RUNS of weather-resistant Duralox are supported by simple extensions of racks. Since Duralox can be used inside or out, number of joints is kept to a minimum.

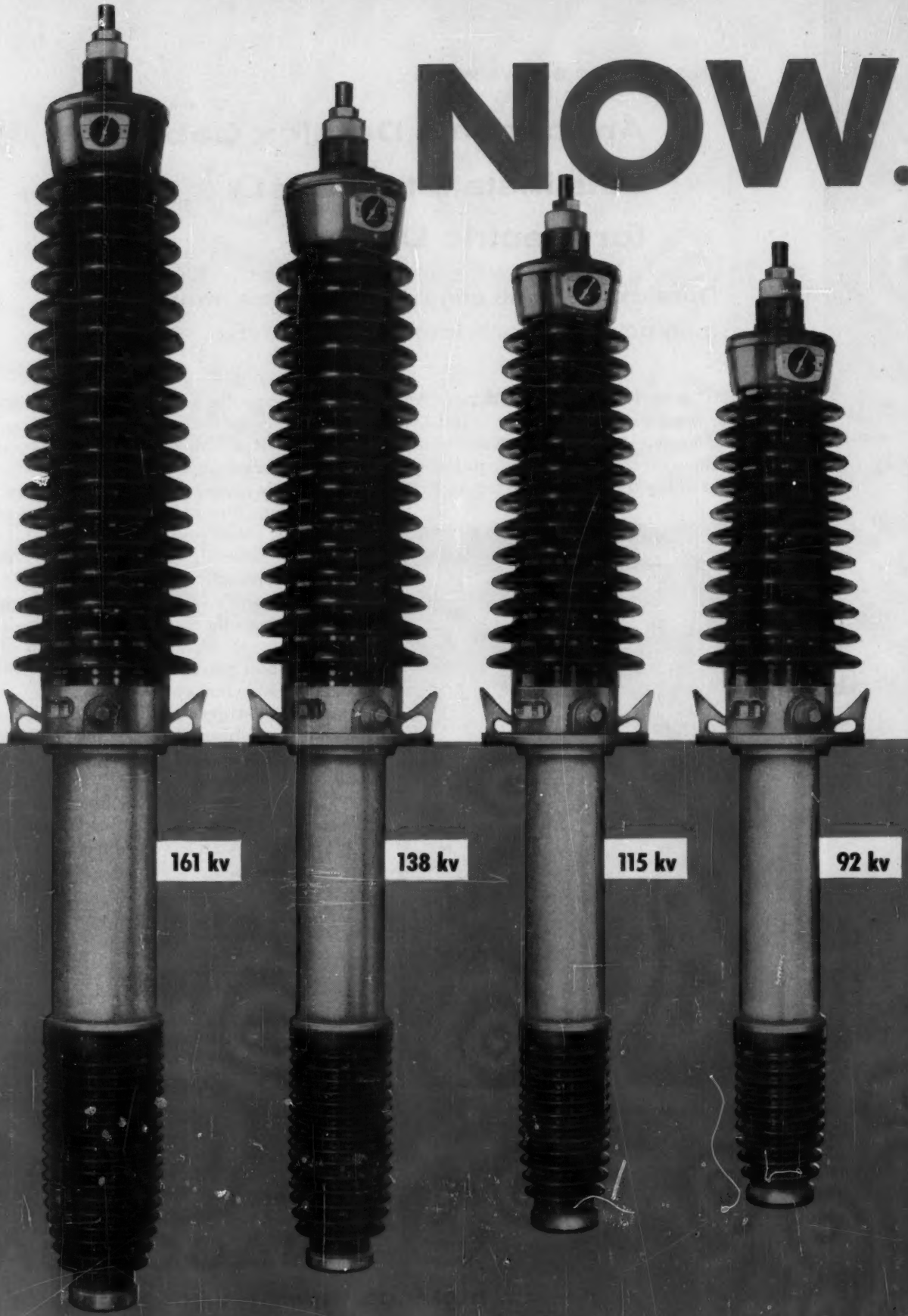
LIVE BETTER ELECTRICALLY

SEE THE MAN FROM

ANACONDA®

FOR **DURALOX POWER & CONTROL CABLE**

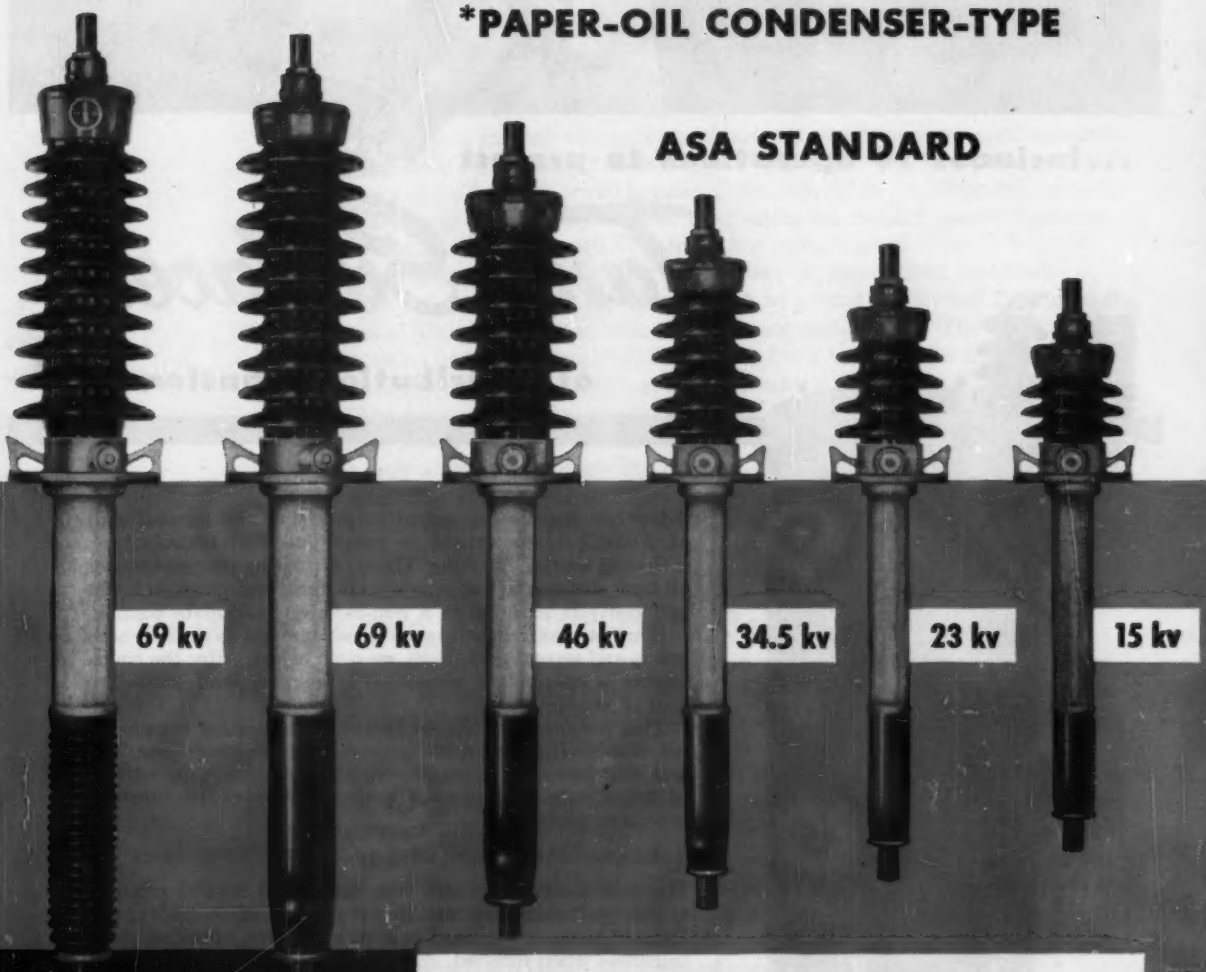
NOW.



. . Lapp POC* Bushings
in voltage ratings to 161 kv

*PAPER-OIL CONDENSER-TYPE

ASA STANDARD



Lapp

At every voltage rating from 15 kv up, Lapp POC* Bushings provide the operating security of totally-enclosed design... ...all exposed insulation is *porcelain.*

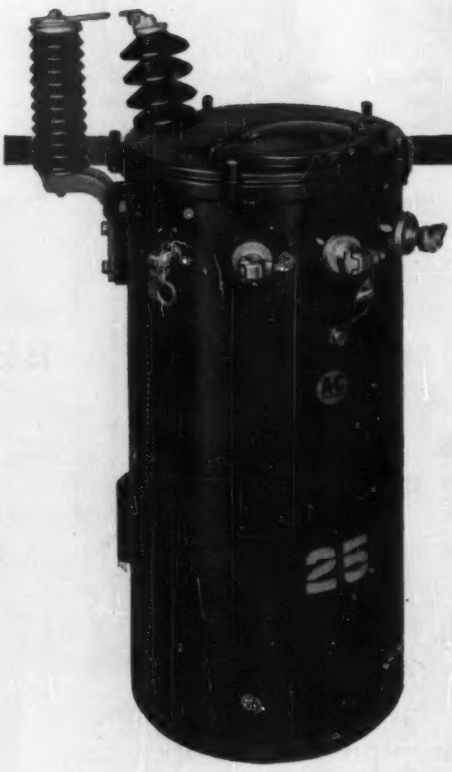
Lapp Insulator Co., Inc., Le Roy, N. Y.

Craftsmanship at Allis-Chalmers

...includes 10 operations to protect

Tank Surfaces

of Distribution Transformers



Advanced engineering, scientific precision and manual skill at Allis-Chalmers extend to every detail of manufacture, including surface finishing. The tank treating process exposes all tank surfaces to five separate chemical and cleaning baths and converts surfaces to a non-metallic phosphate coating.

Synthetic resin base enamel is hot sprayed on tank for both prime and second coat. Both are oven baked. After the transformer is completely assembled it gets its final protective coat of enamel.

This process gives Allis-Chalmers distribution transformers a surface resistant to severest weather conditions, salt and acid atmosphere conditions. The gleaming, gray surface of Allis-Chalmers tanks substantially reduces troublesome corrosion problems.

Extra "Measure" of Corrosion Protection

Magnetic gauging of paint coverage is still another example of the craft and precision in every step of manufacture. Painted tanks are gauged to assure uniform, specified paint thickness when finished.

For the complete craftsmanship story, see your A-C representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS A-C ALLIS-CHALMERS

A-5556

Editorial Comment

June 30, 1958

One Key Reason for Higher Service Voltage!

A thoughtful footnote to the recent editorial calling for a decision on higher service voltage reaches us in a highly-quotable letter from Ebasco's P. G. Whitmore who warns that the industry is overlooking one very fundamental reason for increasing residential voltage. It is that the limitations of *present* wiring in most *existing* residences are keeping many customers from buying appliances they want.

This one reason well warrants all the headaches, all the trials and all the tribulations that a change in service voltage will require, he feels.

"The cost of rewiring such inadequately wired buildings for the present service voltage," writes Whitmore, "is not just a few percent more than for a doubled service voltage, but 3 to 20 times that cost. Why? Because present conduit is too small for larger conductors. To replace the conduit means breaking into walls and replastering, and is a tremendous job from the customer's viewpoint.

"Capacity of existing wiring can be doubled by doubling service voltages and making some other changes which are not very costly. While doubling wiring capacity of inadequately wired homes will not provide for an all-electric home it will go a long way toward caring for most customers and will greatly reduce the cost of additional wiring that a relatively few customers will want.

"These 'other changes' involve replacement of lampholders, receptacles and fixtures not approved for use above 150 v to ground by Section 2113 of the National Electrical Code, or revision of the code requirement. The lampholders, receptacles and fixtures prohibited for use at 240 v by our Code are widely used successfully in foreign countries at 220-240 volts. . . .

"The point is," Whitmore continues, "that the use of autotransformers, which may be a solution for *new* residences, is *not* a solution for existing residences. The only alternatives solving the problem are:

- Develop new lampholders, receptacles and fixtures suitable for 250 volts to ground under the present National Electrical Code, or
- Change the Code to permit such use of present devices."

Electric Heating and the 'Kilowatt-Hour Barrier'

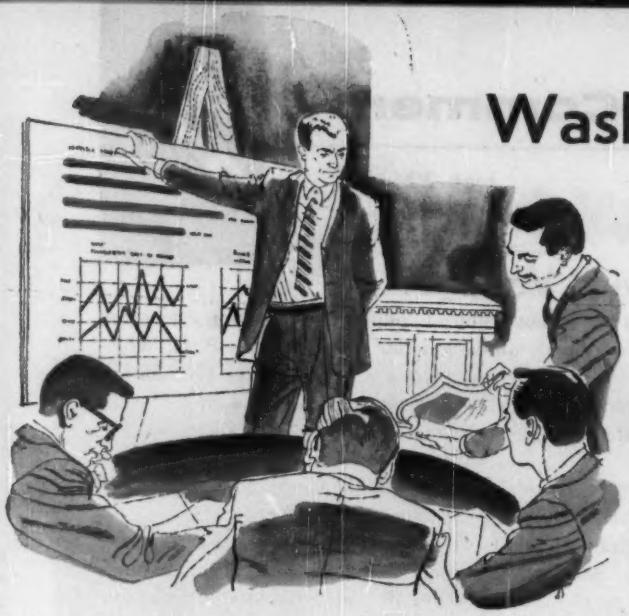
On June 5th and 6th Electrical World, in cooperation with the Electric House Heating Equipment Section of National Electrical Manufacturers Association and selected heat pump manufacturers, sponsored the Third Electric Space Heating and Heat Pump Conference.

The conference is now history; however, much of what was said at it portends the growth pattern of the electric utility (and manufacturing) industry in the years to come. It can be summed up thus: Electric heating and heat pumps —the keystones of the all-electric home—are the only way that we will ever break the "kilowatt-hour barrier", and drive residential consumption upward to the levels about which we've been talking so loud and for so long.

It is also the only way we're going to get the needed new revenues to support capital expenditures under conditions of constantly rising prices.

All the evidence suggests—indeed, in some cases proves!—that an increasing number of utilities realize this. Consumption, revenue, and the cold, hard facts of electrical life, (shifting peaks and dropping load factors) cannot be ignored.

The time for delay is past. Every customer consideration, every long-range economic and possibly political condition is in our favor. Now—NOW—is the time for the electric industry to unite behind electric space heating and form the solid sales base from which it can launch into a more profitable tomorrow.



Washington: Other Woes

- Usual scrimmage between private and public power going on, but neither side makes gains in an atmosphere of comparative quiet
- Big reason is that Congress is preoccupied with Sputniks, recession, and foreign policy. Another is the upcoming elections this fall
- Lateness of session also makes Congressional action on power matters unlikely
- FPC, AEC nominations hanging fire

The usual scrimmage between private and public power advocates has been taking place in this session of Congress, but neither side has made any sizeable gains or losses. The line is drawn in late June about where it was in January.

One reason for the comparative quiet on power legislation has been the Congressional pre-occupation with other matters—Sputniks, the recession, and foreign trade. Another reason is the upcoming election this fall.

Public power advocates lost their bid for a federal Hells Canyon Dam, and began a long-range drive for a valley-type power corporation in the Pacific Northwest. Tighter federal control over nuclear power plants is being pushed in a Democratic-authorized bill for the Atomic Energy Commission, and this may yet be enacted.

Private power advocates got nowhere in their recommendation that electric co-ops be authorized to finance their own construction needs. And any chance of a Congressional investigation into how the Rural Electrification Administration is following the original intent of Congress (when it enacted the 1936 act) cannot be expected until 1959.

Bond Financing—Legislation permitting the Tennessee Valley Authority to issue its own revenue bonds for financing power projects is still a 50-50 possibility. The Kerr "compromise" bill has passed the Senate and is awaiting consideration by the House Public Works Committee. Meanwhile, the House Committee has sent its own, more liberal Jones-Davis bill to the House Rules Committee. This bill (without the area-limitations provisions of the Kerr bill) could be amended on the House floor to conform with the Senate-passed version.

Private financing by rural electric cooperatives—advocated by the Eisenhower Administration—will go by the board this session because no sponsor for such legislation has come forward in either the House or Senate.

Rural Electrification—The Capehart-Hiestand bills to increase REA interest rates are dying in the Senate and House Agriculture committees. This legislation would require electric co-ops to pay back the same interest rates to the REA as the U. S. Treasury was required to pay to obtain the money.

The Humphrey-Price bills—to give back to the REA administrator all loan-making powers transferred from him to the Secretary of Agriculture by a 1953 re-organization plan—will not be approved by the Senate and House government operations subcommittees, which held hearings on the bills. The National Rural Electric Cooperative Association, which backs the bills, claims the legislation would give the REA administrator final authority over loans. However, hearings produced evidence that the Secretary probably has held such power from the time the REA was placed in Agriculture Department in 1939, and that it would be inadvisable to remove a department head's authority over an agency within his department.

Atomic Energy—A newly-introduced Democratic appropriation bill for the Atomic Energy Commission seems likely to be enacted. This would provide nearly $400 million for the AEC during fiscal 1959, including:

- A $145-million plutonium-producing reactor at the Hanford works.
- An $8-million design and engineering study for a heavy water cooled and moderated reactor burning natural uranium, plus similar studies on two large-scale reactors and one intermediate-sized prototype.
- A $20-million budget for several new cooperative atomic power projects—as recommended by the White House.

Congress also is expected to pass a bill, authorizing the AEC to waive heavy water use charges for projects using enriched fuel, as well as natural uranium.

Expenditures for nuclear power development by private electric utilities have been mushrooming since 1955 (see table at right). While cumulative spending up to '55 was approaching $14 million, Edison Electric Institute expects it to be over the mark by 1959.

Take Congress Spotlight Off Power

Nominations—The Senate has unanimously confirmed the nomination of John B. Hussey, former Louisiana Conservation Commissioner, to the Federal Power Commission. Hussey, who replaces Seaborn L. Digby, has no record in connection with the electric industry.

John A. McCone is expected to be confirmed as new chairman of the AEC, replacing Adm Lewis L. Strauss. Senate members of the Joint Atomic Energy Committee should set a date for hearings on his nomination shortly.

Two nominees to the Tennessee Valley Authority are still waiting for the Senate Public Works Committee to hold hearings on their nominations. Both men, Arnold Jones and Frank Welch, probably will be confirmed, although it is reported that hearings have been delayed in an effort to coerce Republican support for a TVA bond-financing bill in the House.

Taxes—The drive to drop a 3% excise tax on freight—along with a 4½% tax on oil pipelines and a 4¢ per ton tax on coal—has shown surprising strength. The Senate voted to drop the freight taxes in its new tax bill, but they may be restored by conferees, who are meeting to iron out differences in the tax bills passed by the Senate and House (the House voted heavily to retain the taxes).

Even if the conferees agree to keep the freight taxes in effect, there is a chance that the cuts might be revived as a rider in the small business aid bill, now before the House Ways & Means Committee.

Trade—The Senate is expected to pass a reciprocal trade extension bill similar to the one passed recently by the House. The House-passed measure, now before the Senate Finance Committee, calls for a 5-year extension of most of the present program, plus an easier chance for obtaining a defense essentiality ruling from the Office of Defense Mobilization.

The House bill would require that only one investigation by the ODM would be needed to determine that imports were impairing the national security by hurting a particular industry. (At present a second, a White House probe, is also being held). ODM also would be required to consider in its investigation the availability of domestic development capital, domestic capacity and production rates, both present and future.

The Senate is more likely to amend the House-passed bill by tacking on import curbs for specific commodities.

Power Policy—The high federal Hells Canyon project has been killed for this session of Congress after a House interior subcommittee defeated (and tabled a motion to reconsider) the Senate-passed Morse bill, S-555. House Subcommittee Chairman Wayne Aspinall (D-Colo.) said "This does it for good; the High Hells Canyon Dam is dead." Vote was 15-13.

A Senate public works subcommittee completed hearings in late May on two bills, introduced by Sen Richard Neuberger (D-Ore.): **(1)** To establish a "valley-type" Columbia River Development Corp, which would have authority to develop, generate, transmit, and market all power in the Pacific Northwest; and **(2)** To change the preference clause of the Bonneville Power Administration (which would also come under the corporation) so surplus power would be sold to industry before private utilities.

Neuberger admits the present bills may not be good ones, but he plans to use the hearings as a basis for writing new bills. The big push on these bills will come next year.

The Senate Commerce Committee has favorably reported a bill, also introduced by Neuberger, which would require the Interior Department to approve all hydro projects, pending before the FPC, which might affect migratory fish. Chances of the bill being passed by Congress, however, are considered slight because of the lateness of the session.

The House Interior Committee is not expected to vote favorably on the Trimble Bill, which would amend the 1944 Flood Control Act by basing Federal power rates only on the added cost of building generating facilities at hydro sites. (Rates presently are based on an allotted portion of the cost of building the entire dam structure.) One more hearing is planned this session.

Appropriations—President Eisenhower has signed the Agriculture Appropriations Bill for Fiscal 1959, including $317 million for REA loans, $25-million for Emergency Loan Contingencies and $9-million for REA administration.

The House has passed and sent to the Senate a Public Works Bill, calling for the following budgets for Fiscal 1959: Bonneville Power Administration, $30,104,000 ($66,000 less than the White House recommended); Tennessee Valley Authority, $16,850,000; Southwestern Power Administration, $975,000 and Southeastern Power Administration, $735,000. (These three meet White House requests.)

Estimated* Expenditures by Electric Utility Companies for Nuclear Power Development (thousands)

	'55 and before	1956	1957	1958	1959
Plant expenditures	$11,193	$25,083	$34,898	$ 52,661	$ 92,592
Other expenditures (a)	2,755	1,989	4,313	6,361	no estimate
Total by years	13,948	27,072	39,211	59,022	92,592
Cumulative	13,948	41,021	80,233	139,255	231,847

* Source: Edison Electric Institute
(a) Includes expenditures for nuclear power study, research and development

Power Consumption at Major Atomic Energy Commission Installations

	Purchased Energy					
	1956			1957		
	Kwhr used (Thousands)	Total cost	Mills per kwhr	Kwhr used (Thousands)	Total cost	Mills per kwhr
Oak Ridge						
TVA	18,147,482	$73,123,302	4.03	17,843,659	$70,792,070	3.97
Paducah						
TVA	12,471,627	49,968,284	4.01	12,099,815	47,037,403	3.89
EE Inc.	7,099,375	27,965,605	3.94	6,765,908	26,115,831	3.86
Portsmouth						
Ohio Valley Electric	17,123,296	66,035,406	3.86	17,060,922	66,583,416	3.90
Ohio Power	778,365	3,416,777	4.39	27,316	176,842*	6.47
Hanford						
BPA	1,551,501	3,966,313	2.56	2,135,689	5,048,319	2.36
Savannah River						
South Carolina E&G	.....	.....	....	330,617	1,876,929	5.68
South Carolina Gen.	502,536	2,854,534	5.68	262,800	1,512,824	5.76
Fernald						
Cincinnati G&E	105,768	904,779	8.55	101,976	900,816	8.83
Total Purchases	57,779,950	$228,235,000	3.95	56,628,702	$220,044,450	3.89
Self-Generation for AEC's Use						
Oak Ridge	1,727,604			1,257,988		
Savannah River	1,147,781			1,051,298		
Total Consumption	60,655,335			58,937,988		

Source: Reports of utilities and operators to the Federal Power Commission. * Discontinued July 1, 1957.

Two Utilities Get Rate Hikes

Commonwealth Ed is granted $26,434,000 annually—all it asked for. Tampa Electric got half of what it requested

Commissions in Florida and Illinois have granted a go-ahead for rate increases by Tampa Electric Co and Commonwealth Edison Co. Tampa's proposed boost of $3,143,000, or 10.9%, was reduced by about half while Commonwealth Ed received approval of its original estimated $26 million bid.

The Florida commission ruled for a 5.6% increase in rates, which will produce $1,620,000 additional annual revenue. On an original cost, year-end rate base, the utility sought a 7% rate of return but the PUC said 6.74% was adequate. Noting that it recently had allowed another Florida utility a 6.98% return on the year-end base, the PUC said the Tampa case involved much lower interest rates as compared with charges at the time of Tampa's last financing.

A fuel adjustment clause sought by the company for all classes of customers was modified to include a fuel cost, generating efficiency, and line loss factors. A commodity adjustment clause was also approved.

Rate base of $100,251,000 advanced by Tampa was pared by $3,106,000. Main cutbacks, the PUC said, were for a 45-day fuel supply duplicated in the materials and supplies allowances; elimination of minimum bank balances; elimination of construction work in progress on which interest is charged, and a full year's depreciation on a new plant which operated only two months in the test year.

In addition, the commission allowed the company the use of normalized taxes.

Commonwealth Ed received an estimated increase in electric revenues of $26,434,000 a year. Net

increase after taxes was estimated at $11,976,000 a year. Commission authorized it to become effective immediately.

To the average residential user this means slightly less than 50¢ a month, said a Commonwealth Ed spokesman.

Small industrial and commercial customer rates were increased 6.2%. For large commercial firms and industrial customers of medium size the increase was 7.8%. For larger commercial and industrial customers the rate increase was 9.6%.

The hike was granted by the commission on the basis of 5.85% return on the "fair value" of the company's properties. "Fair value" estimate was not fixed by the commission but the rate increase they estimated would return 5.85% on a "fair value" of $1,263,454,000. The commission determined that the "fair value" was at least that amount.

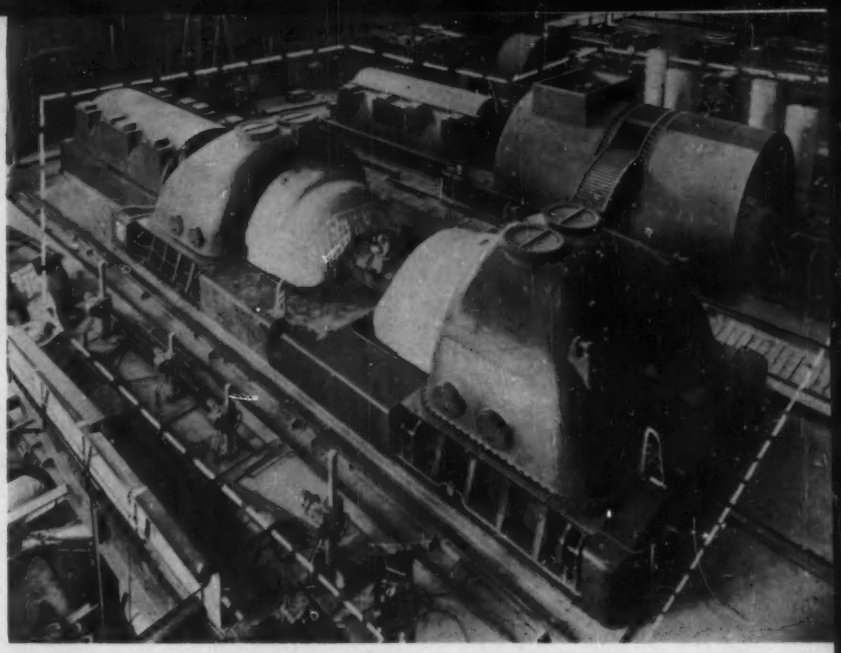
Proposed Coal Rate Cut Stirs Fight in Carolinas

A proposed rate slash by Southern Railway Co on its coal shipments to the Carolinas is causing a furor in those two states and in Washington.

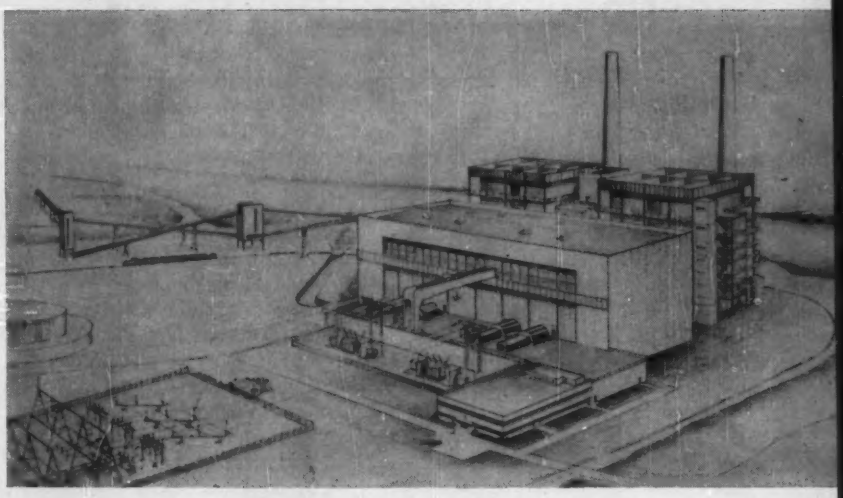
Five of Southern's competitors have moved to block the slash. In protests filed with the Interstate Commerce Commission, they've characterized the proposed cuts as a "destructive competitive practice." The five railroads are Louisville & Nashville, Clinchfield, Chesapeake & Ohio, Norfolk & Western, and Virginian Railway Co. W. Mason King, Southern vp, said his company is answering the charges of the five competitors and "will undertake to show that the commission should allow the rates to become effective as published."

The rate cuts—45¢ a ton on fine coal (for industry and utilities) and up to 80¢ a ton on prepared-size coal (for homes) will mean a yearly saving to Carolina customers estimated at somewhere between $4 million and $6 million.

The new rates were to take effect June 28. The Interstate Commerce Commission decision in the matter is pending as Electrical World goes to press.



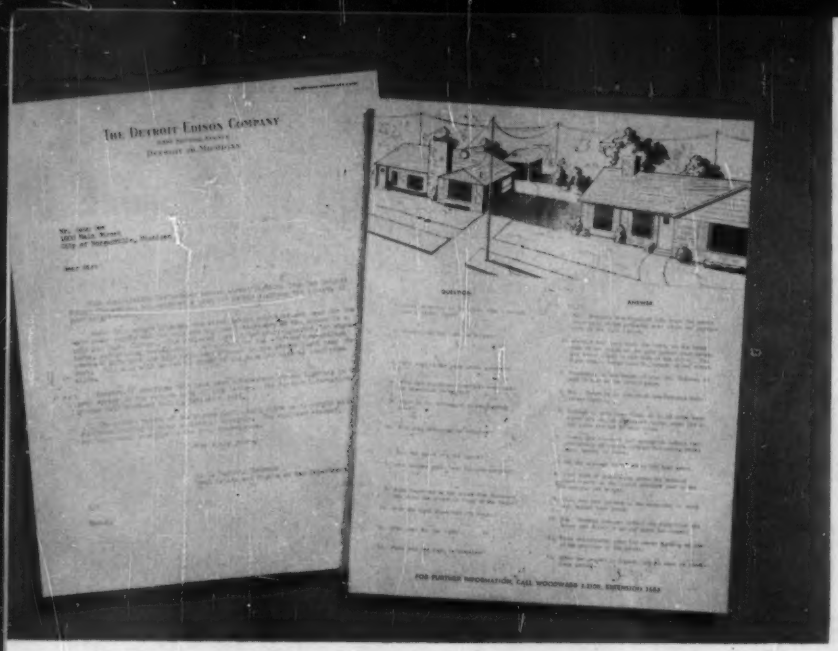
305-Mw Unit Rolls in Illinois . . .



While New Jersey 320's Take Form

Two power companies that were caught with their capacity down last summer are getting geared for hot weather loads. Commonwealth Edison Co, over-taxed last year by unprecedented air conditioning demands, put a 305-Mw turbine generating unit on the line June 11. The cross-compound General Electric Co machine occupies the area shown in dotted lines, top photo, at the utility's Waukegan power plant. The addition is the largest in service to date in the U. S., the company says. It is one of four 305-Mw units the company plans to have in production by the end of 1960.

Duck Island is the site of Public Service Electric & Gas Co's $132-million Mercer plant, which is now under construction. Located a few miles below Trenton, N. J., the station initially will have two 320-Mw units; one slated for 1960 operation, the second in 1961. Each of the cross-compound GE machines will receive steam at 2,400 psi at 1100F. Outdoor station design aims for "the most economic generation of power consistent with the highest reliability and service," the company announced.



Half of street light contacts respond as . . .

Postman Shares R/W Load

RALPH E. BREHMER, R/W Fieldman, Detroit Edison Co

The Detroit Edison Co is meeting the cost factor head on in securing some rights-of-way by mail.

Securing rights-of-way by personal contact is an expensive proposition, especially when the requirements run anywhere from corridors for tower lines to permission to overhang lot lines with overhead street lighting service wires. It is in the latter area that we are eliminating a good percentage of our field contacts by using the mails.

In 1956 we installed 7,364 street lights for 81 municipalities throughout our Michigan Thumb area. Of this number, 2,284 overhead street lights required right-of-way from private property owners. Prior to 1956, all street light contacts to private property owners were made personally by our fieldmen. Today we are securing permission from 50% of these street light contacts by U. S. mail.

Municipalities in our territory request street lights from our Sales Department. These requests go to the Street Light Planning Division which designs the lighting plan to meet both the needs of the municipality and the specifications of the national code.

The modern trend toward locating all residential equipment in deep right-of-way or in easements behind homes creates the problem of getting electrical service out to midblock lights. One duplex wire must be run from the rear easement pole, along side lot lines, to a street light pole near the road curb. The Rights of Way Department is furnished sketches of the right-of-way requirements by Street Light Planning and from this, it is easy to determine what properties are to be contacted by mail. Vacant lots are skipped through use of our customer name files and street address.

A form letter points out modern street lighting features and why we contact particular individuals. The addressee's name is individually typed on each letter.

A picture of a typical street light installation (above) is printed on the letter along with a dozen common questions and answers concerning street lighting and the service wire. We also give our phone number for those people wanting further information. Less than 10% of our mail contacts call in for additional information.

We also enclose a simple permit form for signature consent by the owners. The non-technical language of the permit, specifically designed for street light right-of-way, seldom provokes questions of our intent.

Continuity is no problem in this type of right-of-way since each light is treated as an individual project. Refusals are simply reported back to the municipality, completing the obligation we incurred by the original order.

Those property owners not responding to our letter are contacted personally by a fieldman.

FPC Sets Up . . .

. . . new tax accounting category for utility use

The Federal Power Commission has set up a new accounting category, "Accumulated Deferred Taxes on Income," to be used by electric utilities and natural gas companies for reporting taxes accrued from accelerated amortization or liberalized depreciation methods.

The vague title will allow financial advisors, investors, and reporting companies to consider the accruals as either equity or debt. This is a change from the FPC's proposed new rules, which would have placed the tax accruals under a heading, called "Reserve for Deferred Taxes on Income."

The commission also ruled that:

- Deferred tax accounting will not be mandatory for utilities, which do not elect to use it, provided that state laws do not require it.
- Companies may use a composite method of accounting for depreciation, instead of the "vintage year" original FPC method.

The orders were made retroactive to January 1. The commission held hearings in September, 1957, on the proposed changes, with electric utilities generally opposing revision and gas companies indicating no opposition. The new FPC rules are a compromise.

The revision stems from a June 30, 1956 decision involving Amer Gas Utilities Co, et al, in which the FPC ruled that companies under its jurisdiction may elect to use liberalized depreciation or accelerated amortization methods, but amounts accumulated must be reported to the FPC.

3rd Electrical World Meeting Shows:

- **Electric heating, the keystone of the all-electric home, is the only means by which utilities will break the 'kwhr barrier', and go to higher consumption levels they talk about**
- **Electric heating offers increasingly brighter prospects as a revenue-producer in an era of rising capital costs and as a revenue stabilizer during periods of business uncertainty**
- **Electric heating, by its nature, helps solve the thorny problems of low Housepower and low appliance saturation**

Electric heating—the keystone of the all-electric home—is the only way the electric utilities will ever break the "kilowatt-hour barrier" they are now facing, and go on to the higher consumption levels about which they've been talking for years.

It is also one of their best hopes in solving the increasingly complex problems that run the gamut from peaks to revenues, from distribution to Housepower.

These are the two principal points which emerged from the speeches, the coffee-break skull sessions, and the question and answer periods of Electrical World's Third Electric Space Heating and Heat Pump Conference. Held in New York June 5-6, the conference was co-sponsored by NEMA's Electric House Heating Equipment Section and selected heat pump manufacturers.

Main idea of the third conference was to find out just how much the electric heating and heat pump picture had changed since the muted hostility of the first conference (1950) and the mixture of enthusiasm and raised-eyebrow skepticism of the second (1956). Judging from the intensity of interest, the Third did just that. And the reasons for the interest were not hard to find. Said one veteran conference-goer, whose company has been looking askance at electric heating for years: "Let's face it, we know now we're going to have to live with it (electric heating). It may not be a honeymoon at first, but we think we can eventually make a pretty happy marriage of it."

Timed to "capture" utility top management on its way to the EEI

Speakers at Electrical World Third Electric Space Heating and Heat Pump Conference: More research, more load, more revenues

BYRNE

SHANNAHAN

BROOKS

Annual Meeting in Boston (EW, June 23, 1958, p 85), the conference had a first-day program tailored to management's tastes. Examples:

- What kind of business is electric heating and heat pumps?
- Can we make money with it?
- What are some of its problems?

Setting out to answer these and other questions, speakers covered the legion of variables that a utility thinking about electric heating and heat pumps will have to consider.

Electrical World Publisher and Editor Fischer Black, in his welcoming remarks, specified a few: "The creep of summer peaks northward shows no sign of abating; load factors are still dropping, especially among northern companies having summer peaks; and with capital costs still going up, you will have to find new sources of revenue to support your plant expenditures. Electric heating and the heat pumps look like one of the best answers."

ELECTRIC SCHOOL HEATING is subject of conversation among, l to r, Ohio Ed's G. W. McElhaney, American Electric's Paul Emler, and Dr Hugo Beck

RESISTANCE HEATING PANEL on residential, commercial, industrial markets is composed of, l to r, Cavalier's Wessel, Wiegand's Kreiser, and Berko's Knoll

Load Research a Key

No group of utilitymen talking about load building can overlook load factor very long. A guiding star to rate men and a bugaboo to salesmen who want to sell power the way Macy's sells shirts, load factor has been bandied around utility offices since the industry's birth. But it—and for that matter, all load research—cannot be ignored. Listen to kickoff speaker William Byrne, assistant manager of Ebasco's Sales, Marketing and Public Relations Department: "Throughout the country, summer peaks are continuing their steady climb in relation to winter peaks. Back in 1952, the Southwest had a summer peak 15% higher than the following December. Last year this difference rose to 32%. In the same period, load factor declined from about 62% to 56.4%—5.6% lower.

"Even in New England, the summer peak is rapidly overtaking the winter peak. On a regional basis, summer peaks were 88%, 92% and 97% of the following December peaks for the years 1955, '56 and '57, respectively. In those same years, load factor improved from 57.2% to 60.8%. Translated into return on investment, these figures have real meaning."

And Byrne again: ". . . It takes just as large a cooling unit for the few hot days in the North, as it does

CADWELL

GEORGE

WALLACE

SHEPHERD

in the South. And with the limited hours of use in the northern climes, load factors will tumble faster than ever, unless offsetting winter load is added. This is where space heating comes in, for it is completely complementary to the cooling load."

Byrne went on to outline five findings from a recent load study by Ebasco for Virginia Electric & Power Co:

1. Electric space heating customers have peak demands in the morning. As a rule, they are off-peak to normal residential load.

2. Load factor of space heating customers is better than thought. Homes in the VEPCO study showed that annual load factor, based on the demand at the time of maximum demand of the group (29 homes), was 24.3%. But, based on the demand of the group at the time of residential class peak, annual load factor was 32.3%.

3. Space heating is big load, no matter how you look at it. The VEPCO homes averaged 18,000 kwhr (about six times the national average) per year.

4. Space heating customers are electrically minded. Saturation of electric appliances is high among them.

5. Electric heating customers can usually add major appliances with little or no additional house wiring expense.

But if loads characteristics are important, it must be remembered that they are only an intermediate step to the lifeblood of any business —revenues. Revenues and electric heating can go hand in hand, "in big chunks," said Indiana & Michigan's Commercial Manager J.H.K. ("Jack") Shannahan. Tracing development of the I&M's 4½-year-old electric heating program, Shannahan pointed out that the company is now pocketing more than $300 in annual revenues from some 4,000 customers who are using 21,000 kwhr each; or, in his words, "a tidy package of $1.3 million or 5½% of total residential revenue—from a market uncultivated and unknown 4½ years ago!"

Indiana & Michigan's 4,000 heating customers account for a 1½% saturation among the company's 244,000 residential customers. Despite this low saturation (low compared to other appliances, not other utilities) heating revenues have:

- Acted as a revenue stabilizer for company earnings during a period when industrial revenues were plummeting; and
- Accounted for 43½% of increased revenues in March, 1958 billings over those of March, 1957.

Heating Boosts Appliances

Electric heating holds some other revenue promises, according to Shannahan. It is relatively easy to boost saturation of other electric appliances in an electrically heated home, thus giving revenues a shove upward. As Shannahan put it: "There is a lot of evidence that electric heating makes dollars and sense for the utility."

In a first-day luncheon panel session, Shannahan's boss, American Electric Power Service Corp Commercial Vice President Paul Brooks, made it clear that electric heating and heat pumps made sense to AEP. Speaking on "How a Long-Time Promotor Looks at Electric Heat and Heat Pumps", Brooks characterized his company's outlook as "optimistically enthusiastic." The enthusiasm is not hard to come by: last year AEP heating customers used an average 19,126 kwhrs, paid an average annual bill of $291.32, and boosted revenues almost $2½ million. The optimism was capsuled in (1) AEP Pres Philip Sporn's original prediction that by 1975, his system would be serving a half million electrically-heated homes; and (2) his upping the ante to 600,000 in the light of recent heating growth.

In contrast to American Electric Power's 12-year experience with heat pumps and 4½ years with resistance heating, Western Massachusetts Electric Co announced last fall that it was getting into the business (EW, Nov. 25, 1957, p 82) with a special electric heating rate. Why should a utility, surrounded by non-heat promoting companies, and located in conservative New England to boot, suddenly come for electric heating? Western Mass Pres Howard J. Cadwell supplied some of the answers:

- "First, we came to the conclusion that the all-electric method of space heating is superior to those using combustible fuels. More important, a surprising number of our customers has already acquired this viewpoint, and were knocking at our door.
- "Second, our investigations led us to believe that electric space heating would, because of its obvious advantages, be salable at a moderate premium over other fuels; and we found that a price which would be competitive would also pay a reasonable return on the increment invest-

'. . . The utility which supplies space heating will acquire a significant portion of the major appliance load . . .'

HENDERSON

O'NEILL

GIORDANO

ment dedicated to the 'year-round' air conditioning load.

• "Third, we are an all-electric company, and we face energetic gas competition. We are convinced that the utility which supplies space heating will acquire a significant proportion of the major appliance load.

"The above considerations, together with the observations of companies already in the house-heating business, led us to the conclusion that our company's welfare and future growth depends on the truly all-electric approach to sales.

Western Mass' new rate and promotional efforts have capitalized on evident New England interest in electric heating, and it appears that the company will exceed its first-year quota of heated homes.

Customer Satisfaction a Must

Time and again, speakers noted that the customers' reaction was an important key to any electric heating program's success. No one noted it more carefully than Detroit Edison Vice President E. O. George in his carefully documented, "Customer Satisfaction—Key to Electric Heat Promotion." Said long-time residential promotor George (he is one of the architects of Housepower): "The . . . most important factor in our electric heat promotion is guarantee of customer satisfaction . . . satisfied customers mean good word-of-mouth advertisers." George backs up his customer happiness-guarantee by checking bills, working with contractors and dealers to see that problems are resolved as they arise, and setting up a corps of emergency "no-heat" servicemen.

Of all the markets for electrical heating applications, none is "hotter"—and perhaps ultimately more important—than that of schools. With the already heavy burden of the nation's schools aggravated by the hurling of Sputnik I into orbit, developments which help the teacher improve both his teaching and the atmosphere for learning are to be welcomed.

In a dual presentation, "Executive's Class on School Heating", American Electric Power's Paul Emler and Superintendent of St. Louis' Bayless School District Hugo Beck set down the case for electric heating in schools. Taking his cue from the phenomenal growth of electric schools in the AEP service area (one in '55, 38 on the lines or a-building in '58), Emler went on to point out that with the right rates, system conditions, and ability to serve the load, it is a "natural." Decisions by schools boards are likely to be made along purely economic lines, with little consideration given to intangible benefits. The savings in plant costs by eliminating boilers, boiler rooms, ductwork, etc., is likely to prove very appealing. Equipment is now available which will handle the high ventilation requirements of most schoolroom state codes, and it should be promoted. Electric heating, with its greater convenience, cleanliness and safety, creates a better atmosphere for the learning process.

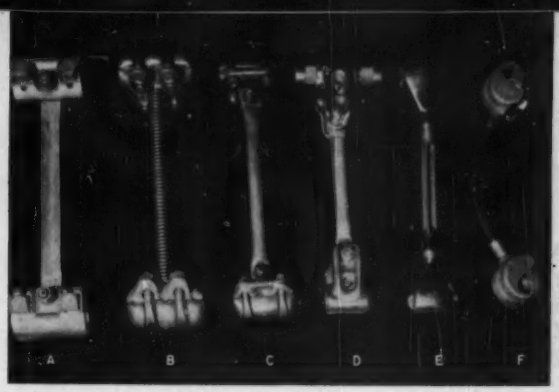
Beck hit upon these points also. Being from outside the utility industry, he brought a fresh, not-commiserating-among-ourselves viewpoint. Presently building an electric school in St. Louis, Beck sketched a few of the savings in construction costs and time; then he went on to describe his ideal all-electric school of the future. Almost everything in it will be done electrically or elec-

WORTHMAN

INGMIRE

FLEMING

(*Continued on page* 77)



SPACER DESIGNS involved in tests to determine forces exerted on spacers on a dual conductor line during short circuits. Preformed spacer G, shown in place, has twin conductors twisted to vertical position for photographing

Measure SC Forces on Spacers

A. L. MALMSTROM, Transmission Engineer, The Detroit Edison Co, Detroit, Michigan

Among the problems in designing a dual-conductor transmission line is the choice and application of conductor spacers. Confronted with this problem, we at Detroit Edison found that, although considerable testing had been done on fatigue and wear, no comprehensive or satisfactory tests had been made to determine the forces exerted on spacers due to short circuits.

To determine the magnitude of these forces, tests were made at our Warren Station late in 1957. Measurements were made at the midpoint of a 400 ft. span of dual 954 MCM—45/7 ACSR conductors spaced 16 in. apart. Fault currents were relayed off in about 5 cycles.

Results of this test showed:

1. Maximum compressive force on spacer was 484 lb with 19,000-symmetrical amperes current.

2. The tensile force on spacer due to conductor rebound is approximately equal to the compressive force caused by the electromagnetic attraction due to the short circuit.

3. All spacers tested, except one, withstood the mechanical force of the maximum short circuit current. Exception was a spacer with a piece of stranded cable between clamps.

4. With no spacer in the 400 ft. span, and 19,400 amps, the twin conductors wrapped around each other and then unwound.

Solid-bar type spacers readily resist the mechanical forces imposed by short circuits but are subject to wear at hinges or joints. We were particularly anxious to learn the effect of short circuit forces on the three non-hinged spacers B and F and the preformed spacer G, shown. Short circuit forces were measured by a strain gauge dynamometer incorporated in a special spacer constructed by our engineering laboratory and research department. It provided reliable and easily readable scale records through an oscillograph. It measured both tension and compression and its calibration in compression was checked by a special compression gauge that measured compression only.

The curve of compressive force vs short-circuit current, shown, was plotted from five different tests. The accompanying table gives the values of compression due to the electromagnetic attraction, and tension due to rebound for the various currents.

Forces increased approximately as the square of the current. This applies to the pull of the rebound as well and indicates that spacers must be designed for "two-way" forces.

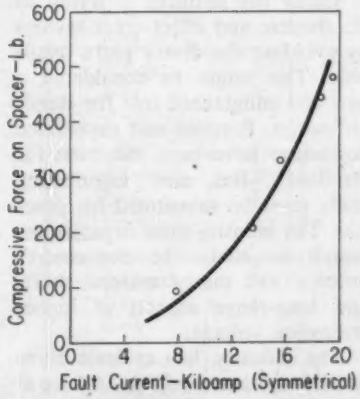
Coiled spring and preformed-type spacers proved adequate to withstand short circuits up to 19,000 amps symmetrical which was the limit of the test set-up.

High speed motion pictures of the test indicate that the longitudinal spacing between spacers should not be much over 200 ft. if wrapping of conductors is to be prevented under high fault currents.

There is still more data needed on life tests of spacers. Vibration damage to spacer or conductor will vary with geographic situations. In-service records will eventually give the most reliable information.

Forces on Spacers Due to Short-Circuit Currents

Sym. Amps.	Asym. Amps.	Duration in Cycles	Compression lbs	Tension lbs
7850	11200	6½	94	65
13180	18200	4½	208	208
15500	22200	4½	331	321
18500	25200	4	448	441
19000	27300	4	484	490



COMPRESSIVE FORCE exerted on spacers as a function of fault current

240/416 and 265/460-V Systems Compared

240/416-V SYSTEM:

Advantages

1. Promotes higher voltage throughout commercial field.
2. Research would probably show savings throughout field.
3. Simplifies practice by using same phase voltage for commercial and residential.
4. Avoids additional transformation, if 240 becomes 1-ph utilization voltage, making system similar to that used in other countries.
5. Offers world market for U. S. appliances, although frequency differences may require modifications.

Disadvantages

1. Saves 10% less on conductors than 265/460-v system.
2. Would encourage sale of two motor lines, 416-v and 440-v, unless 440-v is abandoned.

265/460-V SYSTEM:

Advantages

1. Offers considerable savings on conductors over present practice.
2. Uses 440-v motors and control for economy over 200 hp.

Disadvantages

1. Voltage too high for any EEI-NEMA-preferred-voltage-rated single-phase appliances.
2. Economics restrict use to loads having preponderance of motors and fluorescent lighting, thus perpetuating present voltage elsewhere.
3. Large 1-ph loads would dilute economies of higher voltage and burden consumers with maintenance and operation of transformers.
4. Development of 265-v 1-ph equipment would be inevitable.

Service Voltage Needs Research

Objective is an ideal higher standard voltage which will win universal application for all commercial utilization

A. S. ANDERSON, Electrical Engineer, Ebasco Services Inc., New York, N. Y.

An ideal higher utilization voltage system would show savings for all or nearly all commercial loads. The 265/460-v system* has been selectively applied in many locations and is being accepted by some as the preferred system without benefit of experience or research study of other possible systems.

Today the industry is trying to standardize and effect great savings by avoiding the divers paths available. This might be considered a new and enlightened role for standardization. Practice and experience heretofore have been the basis for standards. But now engineering study must be substituted for practice. The industry must organize research to study the consumers', utilities' and manufacturers' short- and long-range aspects of higher utilization voltage.

The industry has at least three possible systems available. All are at approximately double the present standard voltage level. These are:

1. The 265/460-v system—the one which the industry has shown an inclination to use. This is a 4-wire wye system designed to serve 440-v motors and fluorescent lighting; it requires further transformation for all 120-v and 240-v single-phase load.

2. The "twice present" system is, as the name implies, the same system as presently used but at twice the present voltages. It consists of two wiring connections—one a 240/480-v 4-wire delta for small commercial loads outside network areas and the other, a 240/416-v wye for large spot loads and networks. Additional transformers are needed to serve 120-v equipment. Motors can be of 440-v or 416-v rating applied as 220-v and 208-v motors are applied in present systems.

3. 240/416-v 4-wire wye system —using 416-v rated motors. It would serve 240-v single-phase appliances directly but requires additional transformers for 120-v equipment. This system differs from **2** above in avoiding use of the 4-wire delta.

Architects and industrial engineers evolved the 265/460-v connection to serve war plants. It was part of an efficient distribution developed for serving large areas of industrial machines and high-level vapor lighting. It consisted of dry-type unit substations well-located throughout the plant and supplied by primary circuits. The 265/460-v connection and related equipment proved easy to apply to large commercial buildings with savings in wiring costs up to 30% over the 120/208-v system.

Wiring code changes or departure from existing manufacturing and utilization practice would be required to install either of the other two systems. This seems to account for the wide acceptance of the 265/460-v system.

The industry should apply more intensive study to see if it is justified in taking this path. It should evaluate again each system's advantages and disadvantages, some of which are listed in the table. Research can be counted on to uncover more factors favorable as well as unfavorable for each system. In fact, this should be the goal of further research, together with a proper valuation of each of the factors listed.

(*Continued on page* 84)

* Nominal system ratings are used; it is assumed that transformer secondary voltage ratings are 5% higher.

Idaho Power Co Phase-Failure Relay Reliable

New relay gives full protection to irrigation pumps against substation single-phasing. Two years' applications convinces engineers of its superiority over other methods

PAUL A. OAKES, System Analysis Engineer, Idaho Power Co, Boise, Idaho

Idaho Power Co has standardized on a phase-failure relay of its own design and manufacture for substations serving predominantly irrigation pumping loads. Operating experience of over two years has satisfied company engineers that only this device will protect deepwell pumps adequately against substation single-phasing caused by main bank fuse blowing. To date 24 relays have been constructed in Idaho Power's shops at a cost of about $300 each.

Idaho Power has adopted the less-costly practice of using delta-wye transformers and high-side fuses instead of the breaker in its substations. The fuses also back up the feeder as shown in Fig 1. But when a station serves an irrigation pumping area, this requires reliable protection against high-voltage phase failure, such as the blowing of a transformer high-side fuse.

Irrigation pump load served by the company is composed of many induction-motor deepwell (some over 300 ft) turbine-type pumps, 10 to over 300 hp. Through lack of maintenance, ratchets and self-release clutches normally supplied with deepwell pumps do not protect reliably against widespread phase reversal. In many cases, even though these devices have been maintained, reversal occurs with such force that ratchet and motor-bell housing are totally damaged. Self-release clutches may be unable to stop continued unscrewing due to inertia.

For reliable protection against single-phasing, a relay must be insensitive to simple unbalances to avoid time-delay coordination. Schemes not requiring time-delay but involving ultra-sensitive undercurrent relays were rejected by Idaho Power. Either they required an isolated current source or they were directional, thus responding to certain fault conditions.

Against this background of practices and load conditions, Idaho Power designed the phase-failure relay. It is built from commercially-available parts except for the chassis and saturating transformers. Basically the relay consists of two undercurrent units, L and H, as shown schematically in Fig 2. The H unit has the higher setting. L unit drop-out is called "minimum drop-out current;" H drop-out is "cut-off load." L and H unit contacts are

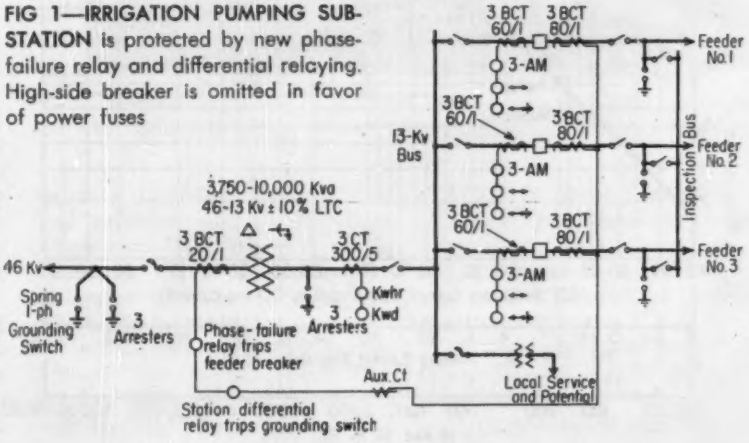


FIG 1—IRRIGATION PUMPING SUBSTATION is protected by new phase-failure relay and differential relaying. High-side breaker is omitted in favor of power fuses

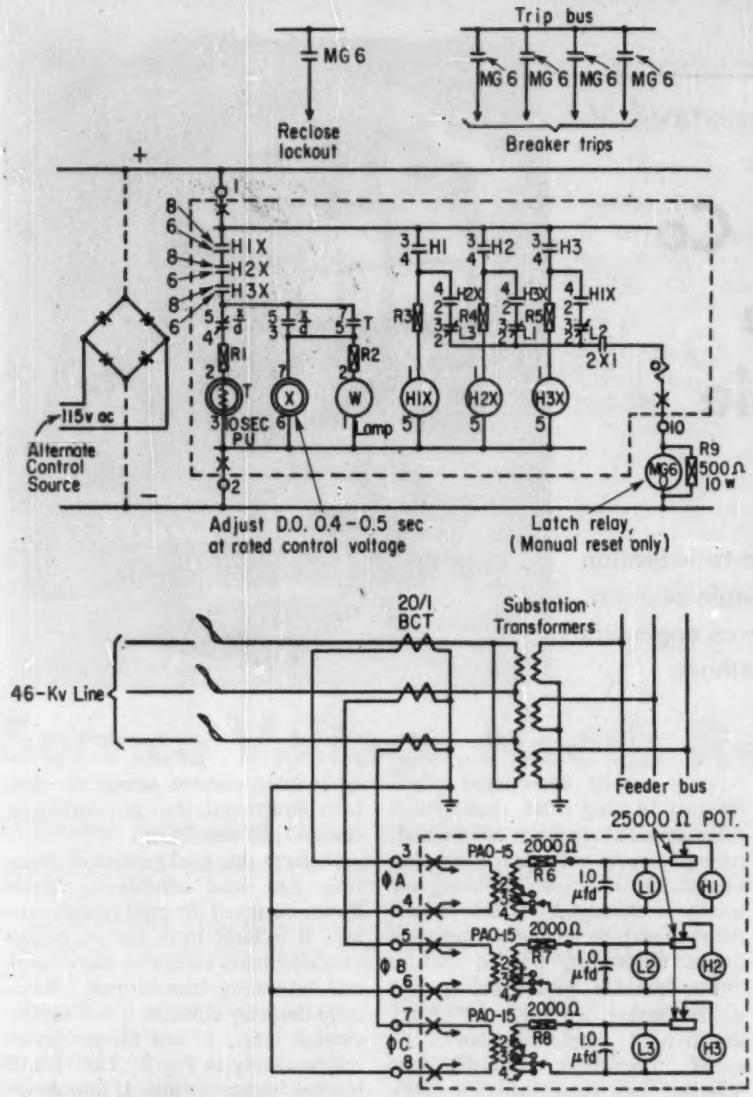


FIG 2—INTERLOCKING SEQUENCE in control circuits of phase-failure relay prevents unnecessary tripping due to gradually-changing or unbalanced load

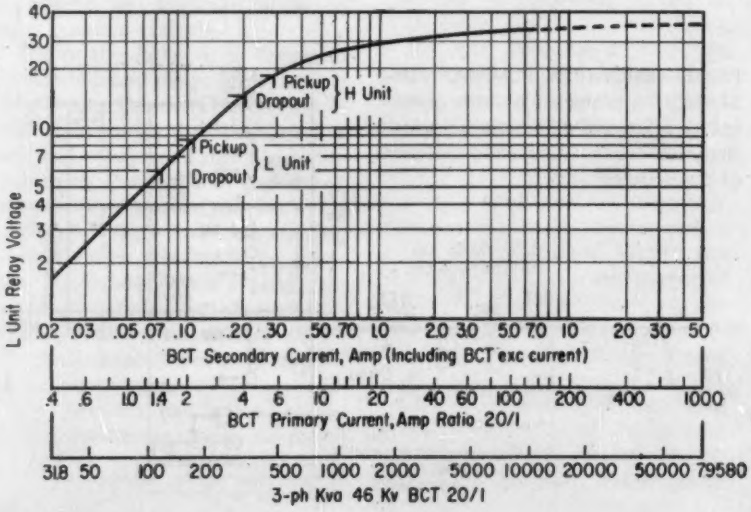


FIG 3—OPERATING CURVE of new phase-failure relay shows how saturating transformers operate to protect it on circuit carrying heavy overloads

interlocked to establish the trip circuit if L and H units of only one phase drop out within about 0.4 sec of one another. This permissive time allows the tripping relay (MG-6) to latch and otherwise prevents incorrect tripping on gradual load reduction through cut-off load.

As current increases to pick up all three H units, there is a 10-sec delay after which the relay is "ready" and will respond instantly on phase failure. The delay prevents incorrect tripping at light load.

The saturating matching transformer is designed for maximum possible transfer of energy from the bushing CT to the L unit at minimum dropout current (see Fig 3). At high loads the transformer saturates to protect the relays. The capacitor and resistor in the ac circuit function as an integrating network to increase low-load sensitivity and limit voltage peaks at high currents.

The phase-failure relay will detect transmission supply phase failure and lock out feeder switches without time-delay whenever substation load warrants phase-failure protection. It is insensitive to fault conditions and switching operations and will ride safely through gradually-changing load cycles, passing through its sensitivity threshold even with unbalanced loads. With its minimum-load operating limit, it requires no isolated current source.

The relay will not trip if all phase currents drop suddenly due to switch opening, or gradually with decreasing load, or if two currents drop suddenly. An adjustment permits any amount of phase unbalance at low loads. The relay will not trip on loss of control voltage. At stations using ac control, auxiliaries have been selected to operate properly on voltages lower than those caused by actual phase failure.

The relay will not fail to trip if phase failure occurs during a fault, if load just before was more than cut-off load. If phase failure occurs below cut-off load, the relay will not detect.

Load-Growth Curves Normalized

JOHN D. SIMONS, Assistant to Manager, Rate & Research Dept, Portland General Electric Co, Portland, Ore.

Normalizing system load growth curves to remove temperature-caused deviations gives more accurate analysis for the effect of economic factors. A method used by Portland General Electric Co uses a 52-week-moving-total plot of net system load requirements, adjusted to a normal degree-day basis.

The moving total — sometimes moving average—method eliminates cyclical or seasonal variations to permit precise analysis of long-time trends. Total kwhr net system load requirement for a complete cycle of the unwanted variations is plotted periodically, and the total "moved" one period for each period plotted. To eliminate seasonal variations, a year's total is plotted on a weekly or monthly basis. The resulting curve smooths out seasonal variations, although brief temperature deviations still cause "bumps."

PGE's temperature-affected load requirements are closely proportional to degree-days based on 65F. Normal at Portland Airport is 4,632 degree-days annually. When load and degree-days are plotted on a 52-week moving total basis, a strong correlation appears. When a 12-month moving-total basis is used, the short-term temperature bumps are still there, but correlation between load and degree-day curves is much more difficult, due to variations in week days per month.

Energy sales curves show even less relations for PGE, because any month's meter readings include energy used over a two-month period.

Key to normalizing load curves for short-time temperature variations from normal is the "adjustment factor," expressed as percentage of net system load per degree-day. To determine the proper adjustment factor, PGE engineers constructed curves arbitrarily using 0.001%, 0.002%, and 0.003% of net system load per degree-day.

Apparently (see Fig 1) the 0.001% adjustment factor provides insufficient adjustment; 0.003% over-adjustment. The 0.002% factor results in an adjusted curve which increases normally, showing that load variations due to short-time temperature changes have been eliminated. This is particularly noticeable between the 45th and 46th weeks in 1956.

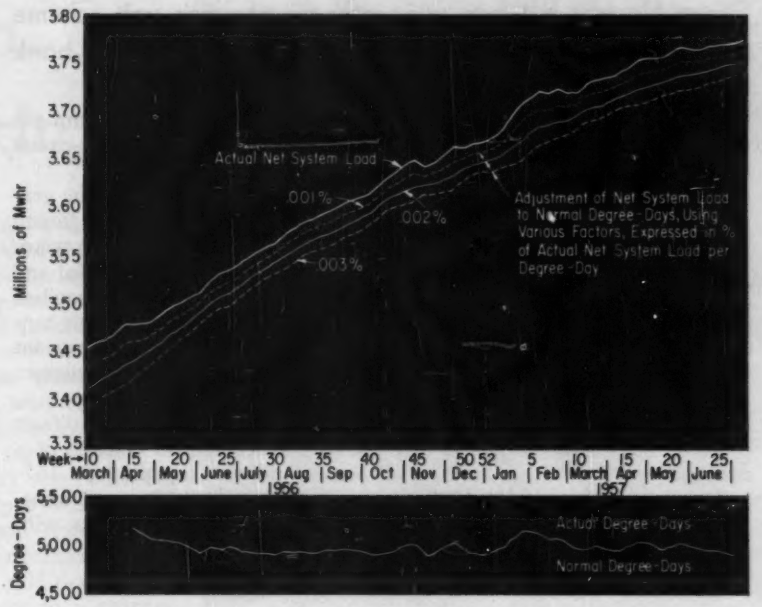


FIG 1—ADJUSTMENTS by arbitrary factors determine the correct one. Under-adjustment by .001%, over-adjustment by .003% factor appears in late 1956

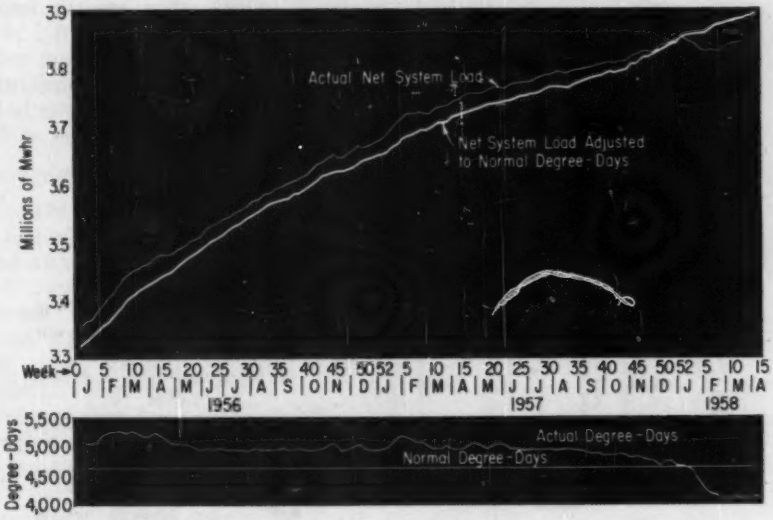

Millions of Mwhr
3.9
3.8
3.7
3.6
3.5
3.4
3.3
Actual Net System Load
Net System Load Adjusted to Normal Degree-Days
Week→ 0 5 10 15 20 25 30 35 40 45 50 52 5 10 15 20 25 30 35 40 45 50 52 5 10 15
J F M A M J J A S O N D J F M A M J J A S O N D J F M A
1956
1957
1958
Degree-Days
5,500
5,000
4,500
4,000
Actual Degree-Days
Normal Degree-Days

FIG 2—NORMALIZED curve, using .002% factor, neatly damps out temperature variations. In winter spring of 1958, area temperatures dragged down load

The following example applies the 0.002% factor to net system load for the 52-week period ending the 45th week in 1956:

3,651,352 Mwhr × 0.002% = 73 Mwhr per degree-day adjustment

5,023 degree-days — 4,632 normal = 391 degree-days deviation from normal

73 Mwhr per degree-day × 391 degree-days = 29,000 Mwhr total adjustment

(*Continued on page* 84)

Ground-Fault Neutralizers Used

Salem Harbor extends generator-transformer unit scheme grounding to Unit 3; cable ties to main transformer bank

E. O. ERICKSON, New England Power Service Co, and
M. T. STANTIAL, Stone & Webster Engineering Corp, Boston, Mass.

Ground-fault neutralizers ground the generator neutrals of Unit 3 at New England Power Service Co's Salem Harbor Station in a generator-transformer unit scheme, such as was used on the two earlier units. This application of ground-fault neutralizers is an extension of what is probably the first of its sort in this country.

The new unit is rated 160,000 kva at 30 psi, 0.975 pf lagging, 14,400 v, 3-phase, 60 cps, 6,415 amp per phase, 3,600 rpm, 0.64 short-circuit ratio.

In this method of grounding generators, the capacitances to ground of the low-voltage transformer winding, the main generator cable, and the generator winding are matched against that of a reactor with taps for providing a nearly resonant tuned circuit having a minimum value of ground-fault current.

The new generator's ground-fault neutralizer equipment consists of a non-flammable, liquid-filled 167-kva, 14.4-kv distribution-type transformer, 15-kv insulation class, with a low-voltage winding rated 120/240 v; a 96-kva, 160-v, 600-amp, 0.42-ohm, single-phase, air-core reactor with taps, 1.2-kv insulation class; and, a single-pole, 15-kv, 600-amp load-break switch. All this equipment is mounted in a steel cubicle near the generator.

Connection from the generator neutral is through the load-break switch and distribution transformer's primary winding to ground, the reactor being connected across the transformer's secondary winding.

Such grounding is a means of limiting damage at the point of fault. It limits transient voltages and proves sensitive in detecting insulation deterioration. Fault currents are limited to less than 1 amp, such a low value of ground current eliminating the necessity of shutting down the unit immediately when the ground fault occurs. This feature gives dispatching personnel ample time for replacing generator capacity before the unit is shut down.

When a fault of low enough resistance to operate the detecting relay does not clear itself, a timer automatically trips the unit after a predetermined time setting of 80 min. Experience with this method at Salem Harbor has been so satisfactory that the company is using it on nine other unit-connected generators.

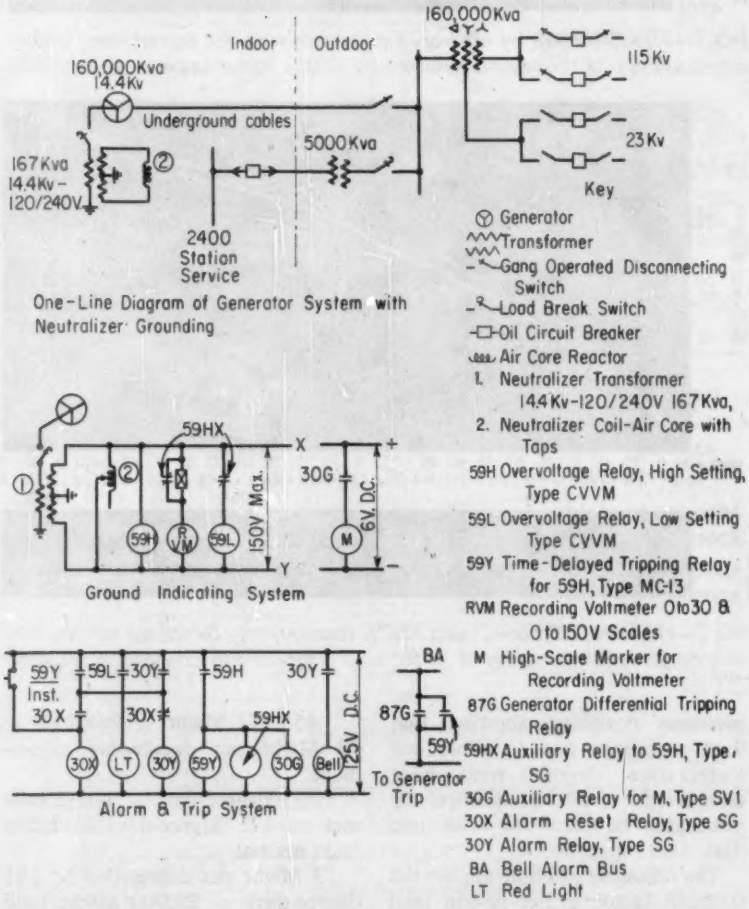
Butyl Rubber Cable Used

Underground cable, insulated with butyl rubber and shielded with a Neoprene jacket, connect the new generator unit to the main step-up transformer bank. There are 27 such cables, nine per phase, and each some 400 ft long. The 1,500-MCM cables are rated 711 amp, or 6,400 amp per phase.

The cables are in three circular duct banks, nine 5-in. fibre ducts on each 26-in.-dia circle. The duct banks are in a triangular formation and about 6 ft apart, all encased in mass concrete. Each circular duct bank is occupied by the conductors of one phase without cable transpositions.

The circular arrangement affords nearly equal current distribution in the generator cable system and dis-

(*Continued on page* 84)



ONE-LINE DIAGRAM shows the generator system at Salem Harbor Station on which ground-fault neutralizers are used to ground all generating units

Al Substation Raised in 6 Hr

A prefabricated, all-aluminum substation was erected recently for Consumer Power Co at Alma, Mich., just 6 hr being required for raising and positioning the sections after they had been ground assembled.

The light prefabricated trusses and structural parts were handled easily by the construction crew. The new substation design was developed in aluminum by Handley-Brown Co, Jackson, Mich., with design and engineering assistance from Consumers Power and Kaiser Aluminum & Chemical Sales, Inc.

M. W. Balfour, general engineering supervisor for Consumers Power, expressed his company's interest in "the strength, lightness, and corrosion resistance of 6061-T6 alloy aluminum and its economical application to substation construction." He said that the 46-kv substation, supplying power service to a refinery in Alma, will be observed closely for evaluation of the many performance factors to be considered.

The design uses standard truss beams, fixtures, and other parts. Trusses are 1 ft square, or 1 ft by 2½ ft, and come in lengths up to 60 ft. They are of welded construction and consist of four extruded aluminum chords supported by lacing. Sides and ends are precision punched with holes spaced at 3-in. intervals.

Heavy Lifting Equipment Unnecessary

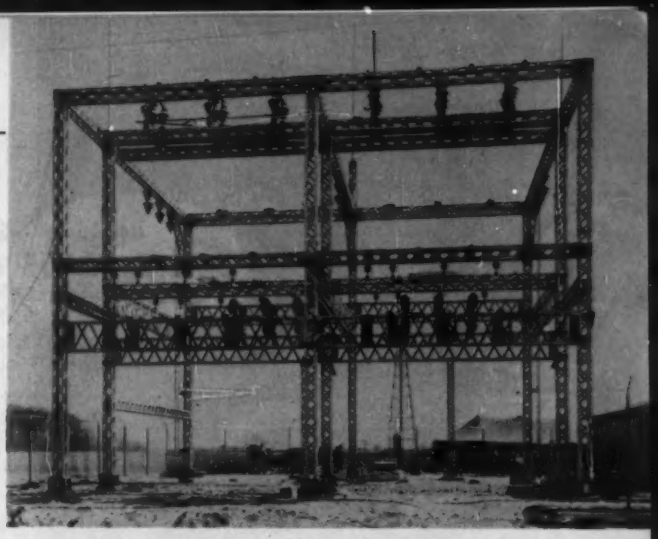
Field assembly at Alma was considerably faster than it would have been were it of the usual construction. Heavy lifting equipment was dispensed with, as a 16-ft truss, for example, weighs only 145 lb compared with 443 lb for an equivalent steel component.

A single portable crane, working from a single position, was used by the construction crew. Vertical columns and cross beams were assembled on the ground and bolted together with strong aluminum alloy fasteners. The crane lifted each "arch" upright onto concrete piers where it was secured with bolts. Horizontal trusses were placed between the arches forming a wing of the substation, this procedure continuing until completion of the structure.

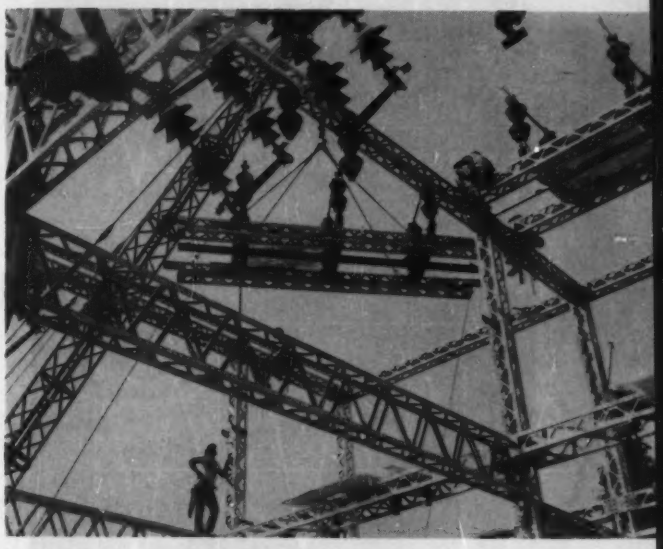
Insulators, switches, and control devices were assembled on the ground also. Once the crane had lifted the sub-assemblies, the crew pushed them with ease into position.

Several visiting engineers were interested in the positioning of the last horizontal truss as a test of the substation's precision engineering. It fitted perfectly without mechanical adjustment.

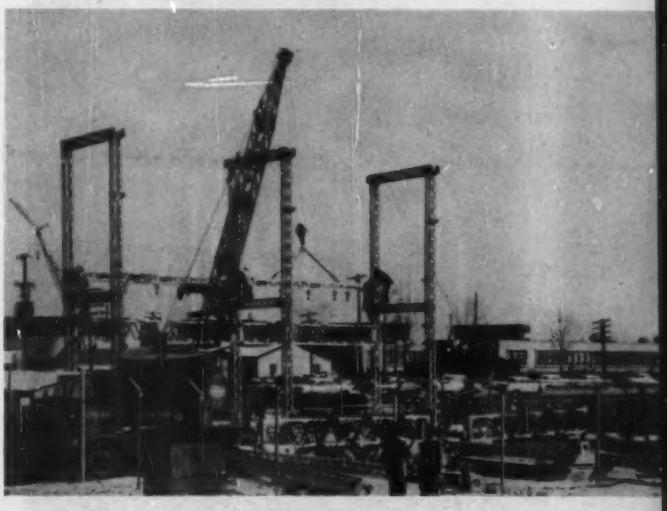
The manufacturer pointed out that savings in transportation and field-assembly costs made the new system practicable, the aluminum providing additional savings in after years because expensive maintenance painting is unnecessary.



Alma Substation structure is completed . . .



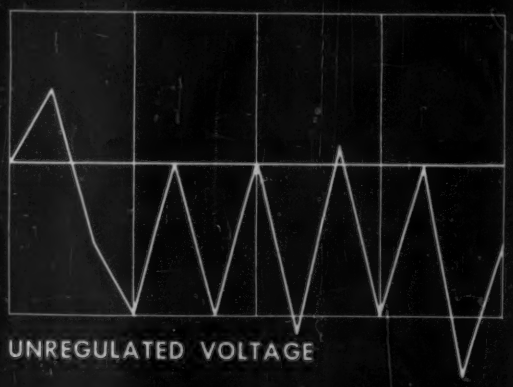
by adding preassembled sections to . . .



. . . columns erected in just 2 hr

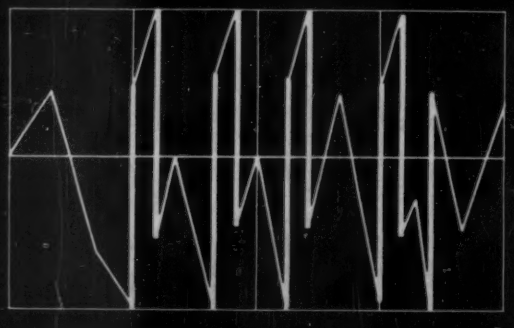
an **EXTRA VALUE** product feature

OPERATION upturn — Buy now for extra values — GENERAL ELECTRIC



UNREGULATED VOLTAGE

⅝% STEPS

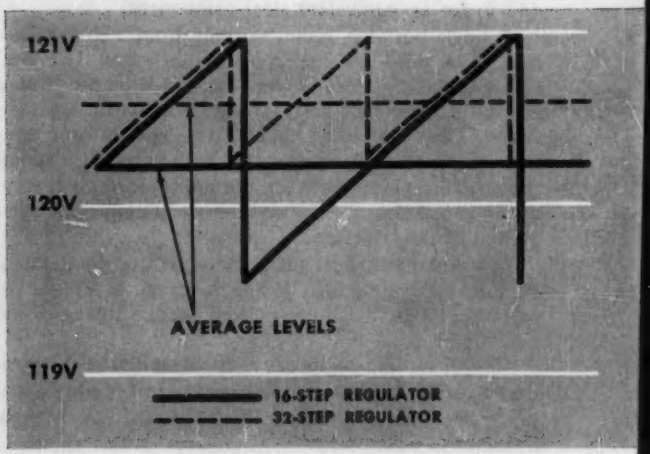


1–1¼% STEPS

The value of 32-step regulators

In actual practice, 32-step regulation offers the optimum *combination* of economy and well-regulated voltage. Here's why . . .

32-STEP REGULATION MEANS . . . . .



16-STEP ADVOCATES select the profile above to prove fewer operations, better average voltage. This assumes that voltage always changes in same direction. Actually, your system voltage fluctuates up *and* down. Realistic examples at left clearly show the facts. Thick, vertical lines indicate frequency of tap switch action.

32-step regulators provide closer regulation, longer life

32-step regulators on a typical feeder can be set to hold a closer bandwidth (a measure of profit and service) with less problem to the utility. This is true, although bandwidth should always be set greater than the size of the step in order to have stable operation of controls and to avoid hunting. Hence, with the same amount of desirable time tolerances (to avoid unnecessary operation), a narrower bandwidth can always be set on units having a smaller step size.

Even with holding effect, which provides assurance against undue relay contact wear and unnecessary switch operation, General Electric regulator controls can be set to hold a minimum bandwidth of between ± ¾ and ± 1 volt. Because of control accuracy—even Class 1—it is impossible for any 32-step or 16-step regulator to hold a true ± ¾-volt tolerance *on the line*. It is highly improbable that field adjustment of 16-step regulators will result in a 2- or even 3-volt tolerance *on the line* because of normal control and human inaccuracies imposed upon a 1½-volt step.

By noting the conditions common to many systems (the three charts at the left), the superiority of 32-step regulation may be seen in terms of reduced operation on average, not "selected" feeders.

The G-E ML-32 need not be untanked for inspection until after the prescribed number of operations—normally covering 20 years or more. One reason: smaller tap voltages mean less electrical wear (contact erosion) per tap change because contact erosion is approximately proportional to tap voltage. Physical wear, on the other hand, has been proven to be relatively insignificant—by test and actual field practice. Five-eighths per cent steps on the ML-32 result in less rupture voltage.

The G-E ML-32 will operate successfully under short circuits of 25 times normal *during* tap changes at any Load Bonus position. Tip life is co-ordinated with the insulation so that the oil does not have to be serviced during the life of the contacts.

Your G-E sales engineer has complete details on why G-E 32-step regulators cost less on the line. General Electric Co., Schenectady, N. Y.

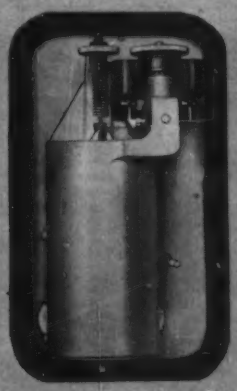
423-28

Progress Is Our Most Important Product

GENERAL ELECTRIC

. . . *General Electric regulators cost less on the line*

ML-32
VRR
WILL
HOLD
± ¾ V
BAND



CLOSER BANDWIDTH means savings in system operation. With the 32-step regulator, a 1½-volt band is easily set and because of time tolerances will be maintained at 2 volts or less. Attempts to hold 2 volts with a 16-step regulator could result in endless hunting.

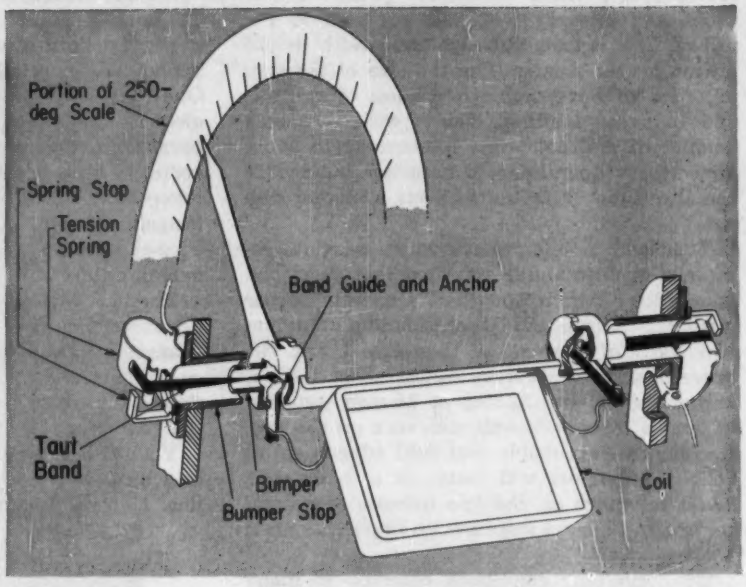
ML-32
TDR
ADJUSTABLE
FROM
10–120
SECONDS

TIME DELAYS of 30 seconds are preferred by most utilities. ML-32 integrated time delay can be set *as desired* for a wide range of time delays (10-120 sec.). Result: Greater ease of control adjustment, greater operating economy, and a better *balanced* job of voltage regulation.

Taut Bands Suspend Moving Element

Taut-band suspension is being applied to 250-deg circular-scale switchboard instruments designed for general industrial service by Westinghouse Electric Corp. This type of system uses no pivots or bearings; thus, rolling or sliding friction is eliminated. The only frictional loss is the infinitesimal molecular friction within the taut metal bands. The suspension system en hances the ability of the instruments to withstand severe vibration and shock with no effect on instrument accurary.

This application is thought to be the first use of taut-band suspension in American-made instruments for general industrial service, and the first use anywhere on instruments with 250-deg scales. The taut-band principle had been applied previously only to laboratory-type galvanometers, a limited number of high-cost American instruments, and some 90-deg scale instruments built abroad.



MOVING ELEMENT for switchboard instrument is suspended by metal bands to eliminate sliding or rolling friction and enhance vibration and shock resistance

In the taut-band suspension, the moving element is supported at each end by a short hair-like band of a special high-strength alloy drawn to a cross section of 0.005-in. wide and 0.0005-in. thick, with less than ± 0.000005-in. tolerance. Bands are anchored to the moving element, and to U-shaped supporting springs that maintain proper band tension and contribute to shock and vibration resistance. Small stops prevent excessive axial and radial movement.

The taut bands also carry the current to the moving coil. By providing restoring torque, the bands eliminate the need for the usual spiral-spring assemblies. Sensitivity of the taut-band instruments is such that full-scale deflection can be obtained with currents as low as 50 μa.

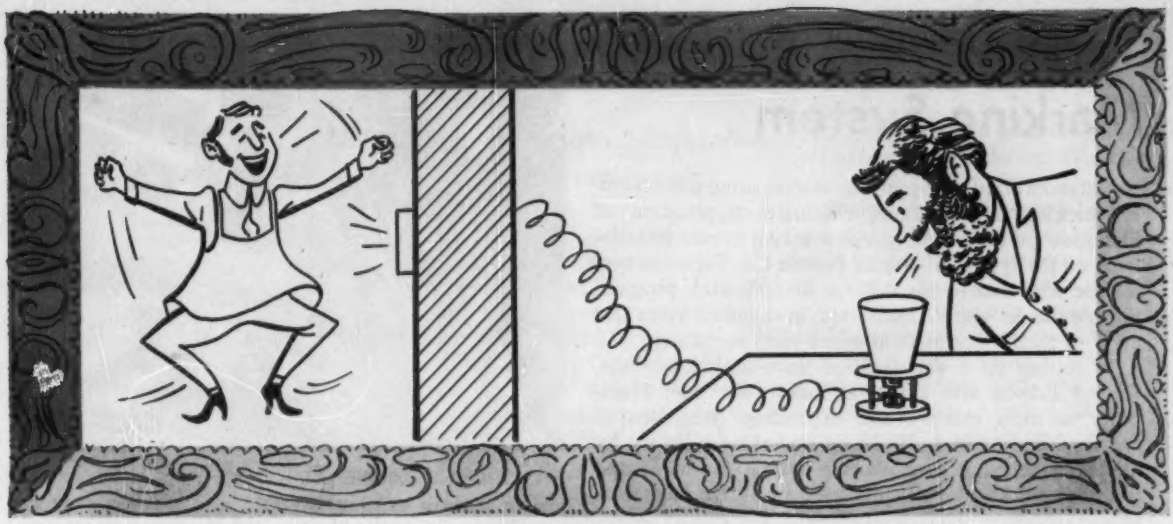
Carry Fences Safely on Truck Front

WAYNE GLASSCOCK, Wireman Helper, Department of Lighting, Seattle, Wash.

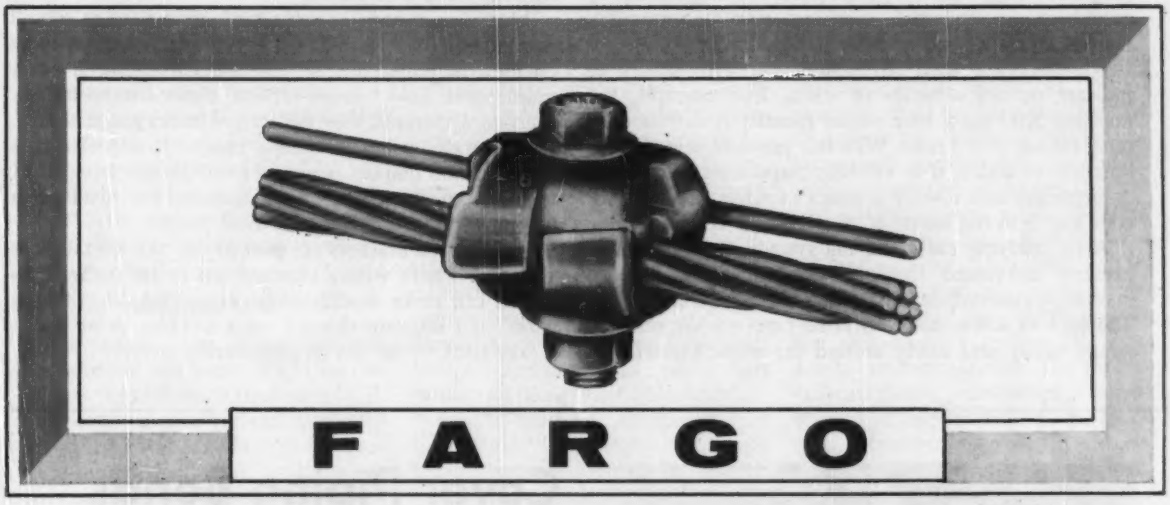
Safety fences used by underground crews are carried safely in special mounts on the front of Seattle City Light underground service trucks. This new method will save an estimated $300 annually by eliminating damage to fence sections. In the past, they had been carried on the sides of trucks and thus were in an exposed position during movement through narrow alleys.

As illustrated, the fence uprights fit into pipe sections welded to the truck's front bumper. Upper horizontal bars fit over a bracket bolted to the front of the truck.

(*More How To on Page* 56)



FAMOUS CONNECTIONS
that last and last...



"600 Series" CONNECTORS

Fargo Parallel Groove Connectors also make connections that last and last.

The "600 Series" castings are heat treated aluminum and inhibitor coated for additional corrosion resistance. Extra high strength, hot dipped galvanized steel bolts or specially fabricated aluminum alloy bolts are used. The hexagon head carriage bolt provides a grip for a back up wrench eliminating the kinking of small conductors.

Longer contact areas assure good interstrand connections and, also, give more protection to the conductor when the clamp is tightened. Long, diagonal fingers wrap around the conductor keeping the strands in place and giving perfect alignment of the conductor in the groove.

The "600 Series" is a durable, dependable connector that makes connections that last and last.

Ask your Line Material Field Engineer for complete details.

Distributed by
LINE MATERIAL INDUSTRIES
McGraw-Edison Company
Milwaukee, Wisconsin
In Canada, CANADIAN LINE MATERIALS, LTD., Toronto, Canada

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie
New York

Tape Markers Speed Marking System

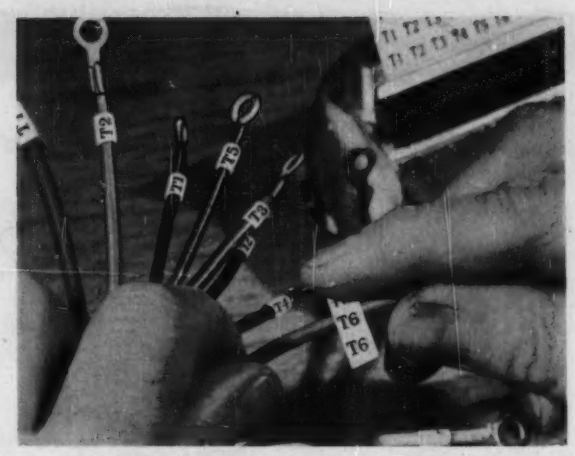
A standardized wire-marking system using permanent, self-sticking tape markers eliminates duplication of identification codes and speeds marking of new installations on the system of Detroit Edison Co. Tape markers for the wire and terminal block identification program are simple to apply. Estimated installation costs are 10% of the former method which used metal tags.

In setting up a standardized wire-marking system, Detroit Edison also aimed at these objectives: Flexibility to meet existing and expanding conditions; a standard code which would be understood clearly by all personnel; and a numbering system for wires and terminal blocks which would insure positive identification.

At Detroit Edison, the standard nomenclature for phase markings is X, Y and Z. These letters are the key prefixes in any circuit involving current and potential. Remaining letters of the alphabet are assigned specific purposes. Single letters so assigned are augmented by combinations of letters covering current, potential, control, breakers and miscellaneous circuits.

Numbers are used in conjunction with letters to indicate one of a series of wires. For example, the marking XB1 on a wire would identify it as phase X, relay circuit, No. 1 wire. With this pre-determined combination of codes, it is virtually impossible to confuse or duplicate any one or a series of wires. The master code key is in the hands of all personnel concerned.

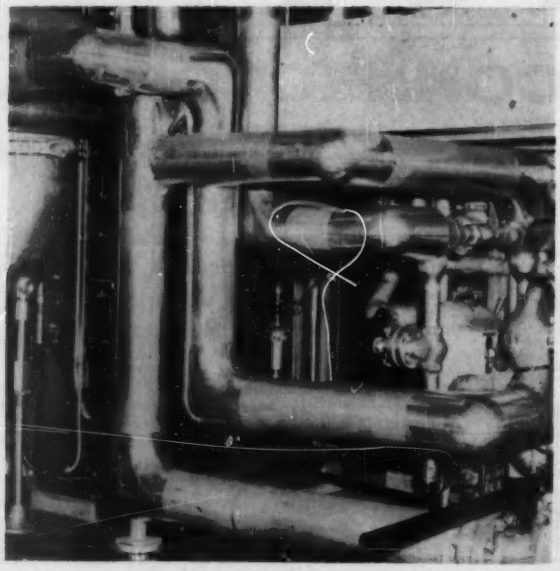
After studying the metal tag system, Detroit Edison became convinced that self-adhesive printed wire markers would reduce installation and re-marking costs. The type of self-adhesive printed tape marker selected wraps neatly and easily around the wire. Electricians and installers can mark a wire or terminal block quickly without the use of tools.



SELF-STICKING MARKERS are applied in a wire-marking system devised by Detroit Edison Co. Markers may be applied over any existing metal tags on terminal blocks

Many wires have been re-marked as new or rebuilt equipment was installed. This work accompanied changes in panel boards, distribution cabinets, communication lines, house-service throw-overs, battery charging apparatus, flow meters and boiler gauge boards. In re-marking existing terminal blocks, an adhesive-type identification marker is placed over the old stamped or engraved marking, thereby eliminating the need for a new pre-stamped or pre-engraved block.

Kits of tape markers are part of the tool kit taken to a station where wiring changes are to be made. Personnel can make modifications as needed, identify the wires, and indicate changes on a working print which is sent back to the design engineering group.



Cover Piping Bends with Aluminum Elbows

Right-angle bends in insulated steam lines can be enclosed quickly and at less cost with a new preformed aluminum elbow. This is the experience of Kansas Power & Light Co, which made the first installation of about 400 elbows on steam lines at the new Tecumseh, Kansas, plant.

The new elbow, preformed of aluminum sheet, eliminates the form-fitting practice usually followed when jacketing insulation material at bends or L's. The elbow has an almost squared-off, rather than rounded, contour. It fits both sharp or gently curving turns without the need for cutting away insulation.

Elbows are installed by placing the deep-drawn halves around insulated turns and then joining them with aluminum screws. An average of 9 min is required for each elbow. The elbow is made in 12 sizes.

Cites Economies for T&D Group

Bettersworth ticks off for EEI five techniques improving reliability which effect distribution design economies

Techniques for increasing reliability provide the greatest opportunity for achieving distribution design economies, while improving service quality. T. A. Bettersworth, Pacific Gas & Electric Co, told the May 7-9 Los Angeles meeting of the Edison Electric Institute's Transmission & Distribution Committee. He listed five basic techniques:

- Live-line maintenance
- Design and maintenance keyed to specific exposure conditions
- Use of automatic reclosing devices
- Highly coordinated protection to isolate persistent faults
- Facilities and procedures for rapid service restoration.

The "utilization transformer," an experimental device facilitating a "plug-in" approach to residential distribution, was described by H. G. Hally, Iowa Power & Light Co. The utility is considering service to large-usage customers with a transformer to 25 kva on each property at the residence wall.

Designs Utilization Unit

To reduce costs of conventional transformer and vault, IP&L has designed the utilization transformer. A conventional core-and-coil assembly is sealed in a 21x24x18½-in. surface-mounted oil tank, with underground primary and service cables entering through conduits sealed to the tank bottom. The open conduit ends extend above oil surface.

Transformer capacity is varied by changing core-and-coil assembly. The system can be applied to O/H and U/G primary systems at favorable costs compared with conventional methods. It is applicable to demands up to 50 kva per residence without going to higher utilization voltage, Hally said, but a higher voltage would require only a core-and-coils change.

An experimental installation uses 8-kv No. 8 single-conductor butyl cable and bare neutral, with 3/0, three-conductor 600-v service cable. Internal connections are made under oil. The transformer sits on a concrete pad and is enclosed by a locked, louvered, steel enclosure.

Economic loss through lack of transformer diversity probably is offset by installation savings, said R. W. Coursey, Oklahoma Gas & Electric Co. But he advised excluding moisture-breathing through conduits by sealing. N. R. Schultz, General Electric Co, urged use of VCL 15-kv primary cable to meet IPCEA specifications and prevent insulation deterioration from oil and fumes. M. G. Leonard, Westinghouse Electric Corp., suggested reducing use of HV cable by looping primaries. Higher utilization voltage is a better path to reduced distribution costs, said L. D. Cronin, Ebasco Services Corp.

Low-cost residential underground, evolved by Southern California Edison Co, is showing sharp popularity increase, 1,775 installations having been put in or planned between January and April, said J. W. Lauder. Net price to customer (difference between O/H and U/G facilities), including power and communications, is as little as $250, depending on terrain and lot layout. Design prevalent ten years ago would run three times as high today.

Present methods use semi-buried transformer housings, pole-type transformers, pullboxes in lieu of vaults and manholes, and direct-burial ducts. Electric pullboxes have gravel floors, concrete-block walls, prefabricated concrete frame to 1 ft below grade, and concrete covers. Los Angeles telephone companies use pullbox construction.

Bell System engineers are agreeable to removal of code restrictions on joint usage with underground electric distribution, said W. H. Johnson, American Gas & Electric Service Corp. Their attitude is attributed to recognition of design advances. Studies toward code change recommendations are conducted by an EEI-Bell joint subcommittee.

But trial installations using joint trench construction are needed to bolster the subcommittee's work, Johnson noted. He reminded the EEI group such test installations are permitted by the National Electrical Code.

Design for utility underground service to large shopping centers must be flexible and tailored to the developer's layout, through certain restrictions protecting installation and maintenance needs must be enforced, said R. L. Bryan, Southern California Edison Co. The utility has had experience with eight shopping centers in service and 21 more building or planned. Transformer capacity for all these will aggregate about 104 Mva. About half the service is at 120/208 v, almost all the rest at 240 or 480 v. 3-phase.

Constant review of underground construction mechanization methods was urged by I. H. Purinton, New Orleans Public Service, Inc., to accelerate the art.

A low-bed trailer having a bed-lowering action similar to "disappearing" coast artillery motions was described by Purinton. Heavy underground construction machinery can be driven off or on the lowered bed within 4 min, while blocking only one traffic lane. New Orleans PS has reduced cable-pulling costs with a triple reel gig, loaded in the utility yard with exact cable lengths for simultaneous pulling of three single-conductor cables. The gig has self-contained, reversible, speed-controlled electric motors, and loads from free-turning storage reels through a length-measuring register.

Almost all line and substation yard work will be done from trucks having hydraulically controlled platforms or work buckets, predicted H. E. Cody, Cleveland Electric Illuminating Co. All distribution cables eventually will be direct-buried, HV splicing will be by machines, and LV manual splices will be simple pressed connections insulated by poured plastic and protected by tough outer shells.

Meanwhile, utilities can lower construction costs by use of equipment available, continued Cody. A $2,000 engine-powered compactor used as a leveller-roller permits CEI to do its own asphalt repaving at annul savings to $6,000. And the company has fully accepted hy-

(*Continued on page* 70)

Chart Solves Transmission Sag Problems—II*

FRANCIS J. HUBERT, Associate Engineer, Los Angeles Dept of Water & Power, Los Angeles, California

Two problems are presented to illustrate the use of the accompanying single chart to solve sag problems. The chart consists of a family of curves of various values of Z, based on an empirical equation, developed by curve-fitting to the catenary. It is suitable for level span sags and can be adapted for a nonlevel span.

Problem 1

GIVEN an ice-loaded horizontal span between two dead-ends where:

$S = 37.5$ ft	$L = 1{,}000$ ft	$A = 1$ sq in.
$w_1 = 3$ lb per ft	$t_1 = 30$F	$E_1 = 9 \times 10^6$
		$\alpha = 10^{-6}$

DETERMINE sag with no ice and a different modulus of elasticity and length due to creep with age.

$w_2 = 1$ lb per ft	$E_2 = 10 \times 10^6$
$t_2 = 60$F	Permanent elongation = 0.03%

The possibility of all these variations appearing in one practical problem is remote. But the example shows that, regardless of number of variables changed at once, simplicity of the calculation does not vary.

$$\%S_1 = \frac{37.5 \times 100}{1000} = 3.75\%$$

$$Z_1 = \frac{3 \times 1000 \times 10^6}{9 \times 10^6} = 333$$

From the chart, $\%\sigma_1 = 0.264\%$

From Eq (7) percent slack at 60F may be calculated. Total slack equals slack at 30F plus elongation due to temperature rise and permanent stretch.

$$\%\sigma_2 = \%\sigma_1 + 100\alpha\Delta t + \text{permanent stretch}$$
$$= 0.264 + 100 \times 10^{-6} \times 30 + 0.03 = 0.324\%$$

$$Z_2 = \frac{10^6}{10^7} = 100$$

From the chart, sag is 3.67% or

$$\text{Sag} = \frac{3.67 \times 1000}{100} = 36.7 \text{ ft}$$

Problem 2

GIVEN a span between two dead-ends where:

$L = 1{,}000$ ft	$A = 1$ sq in.	$E = 10^7$
$h = 50$ ft	$w = 1$ lb per ft	$\alpha = 10^{-6}$

FIND sag at 100F to give a sag of 10 ft at 60F, when stringing temperature is 100F.

Convert the nonlevel span to an equivalent level span, calculate the change, then convert back to the nonlevel span. Sag of a horizontal span with the same tension, from Eq (5) is:

$$S_1 = \frac{50}{4} + \frac{10}{2} + \sqrt{\frac{10\,(50+10)}{4}} = 29.75 \text{ ft}$$

$$\%S_1 = 2.98\%$$

$$Z_1 = \frac{1000}{10} = 100$$

$\%\sigma_1$ (from chart) = 0.194%

Note: 0.194% is slack in the equivalent level span and not in the original nonlevel span.

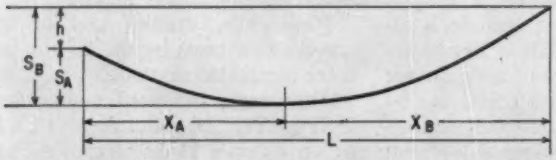
Slack at 100F = slack at 60F + elongation.

$$\%\sigma_2 = \%\sigma_1 + 1000\alpha\Delta t$$
$$= 0.194 + 100 \times 10^{-6} \times 40 = 0.234\%$$
$$Z_2 = 100 \text{ (same as } Z_1)$$

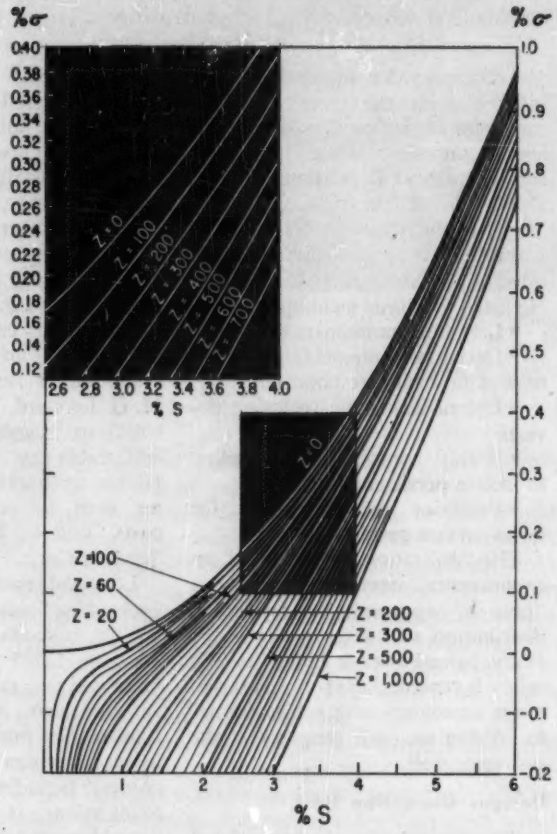
New sag of the horizontal span (from chart) is 3.2% or 32 ft.

Sag at 100F of the nonlevel span from Eq (4) is:

$$S_A = 32\left[1 - \frac{50}{4 \times 32}\right]^2 = 11.87 \text{ ft.}$$



METHOD IS GOOD for nonlevel spans, too. Convert to equivalent level span, calculate changes then convert back.



CURVE FAMILY shown follows empirical equation, developed by curve-fitting to the catenary. Upper left is spread of most-used portion

* Part I with explanation and application of the chart appeared in Electrical World, June 16, 1958, p. 58.

Westinghouse Builds Bearingless Instruments

Instruments with a taut band suspension system that uses no pivots or jeweled bearings are in production at the Westinghouse Instrument Dept in Newark, N. J. Superintendent W. R. Pritchett (center) is showing one of the first units to come off the production line to Sales Manager J. M. Heggy (left) and Department Manager A. J. Petzinger.

Pritchett is holding a Type KX-241, 250-deg circular scale instrument in which the taut band suspension development is being introduced. He stated that the principle of suspension is similar to that for galvanometers. In this KX-241 line the moving element is supported at each end by a rectangular hair-like band 0.00500 in. wide and 0.00050 in. thick. The bands are permanently attached to U-shaped springs to maintain proper band tension and lessens shock and vibration.

This Westinghouse line of circular switchboard instruments comprise dc ammeters, milliammeters and microammeters, and voltmeters and millivoltmeters; also frequency meters with transducers, ac voltmeters, milliammeters of rectifier type.

Instruments of the KX-241 line meet and in many instances exceed requirements of ASA Specification C39.1 for switchboard indicating instruments of the 1% accuracy classification.

Production is being accelerated to reach full scale by year end.

Square D Mobile Showrooms Go on Area Tours

Square D Co, Detroit, has two 18-ton mobile showrooms scheduled for a year-long tour of 100 U. S. cities.

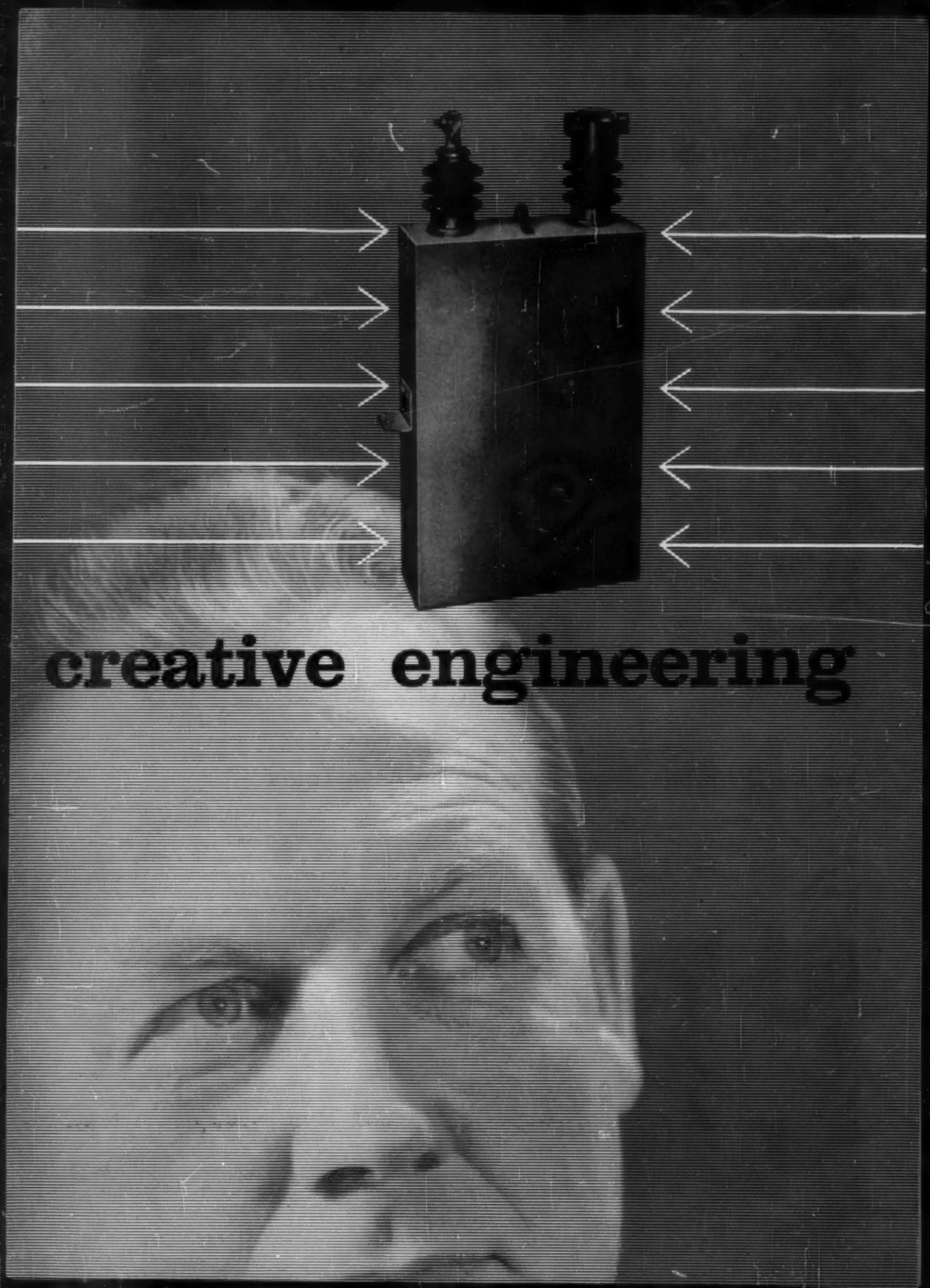
The pair of specially designed motor liners presents the company's electrical distribution and motor control products. Demonstrations are being staged for utilities, industrial firms, purchasing agents, contractors and consulting engineers.

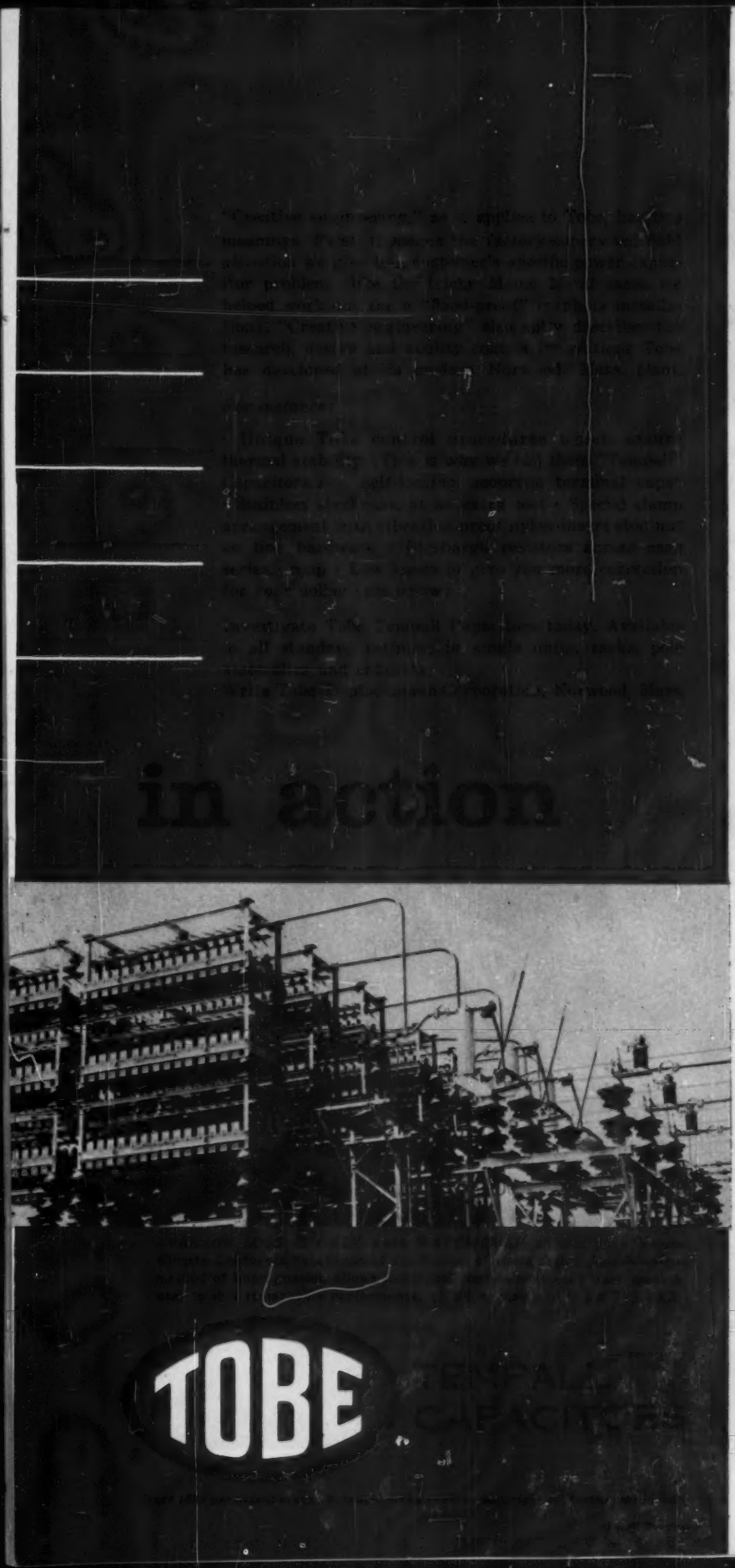
These product liners feature do-it-yourself exhibits. Visitors can operate the controls of a crane hoist, manipulate pushbuttons on an automated machine tool panel, adjust the delicate mechanism of an electronic timer, create a power overload to observe the action of circuit breakers, and perform other operations.

Manufactured by General Motors Corp, the 33-ft long display coaches carry 10-kw generators for power, exhibit lighting and exterior lumination. When the caravan arrives, the showrooms can be "set up" in 1¼ hr. Movable wings open on the sides of the coaches to expose exhibits and provide spectator ramps. Lighted canopies (2500 w) are lifted 8 ft above coachtops for night display.

The product caravan also includes

(*Continued on page* 61)


creative engineering



Square D Showrooms

(*Continued from page 59*)

a smaller vehicle equipped as a hospitality coach to serve light refreshments.

July 1-17 exhibits by the product caravan will be Worcester and Springfield, Mass., Albany, Schenectady, Utica and Syracuse. The exhibits drew large audiences in the southeastern area of the country, also in the Middle Atlantic and New England areas.

Other exhibits are being scheduled for the north and south central states and west as far as the Rocky Mountains. Meanwhile three Volkswagens carrying product displays have left the company's Los Angeles plant to tour western states.

GE Reports Developments on Turbine-Driven Units

General Electric Co reveals information on three outstanding drives.

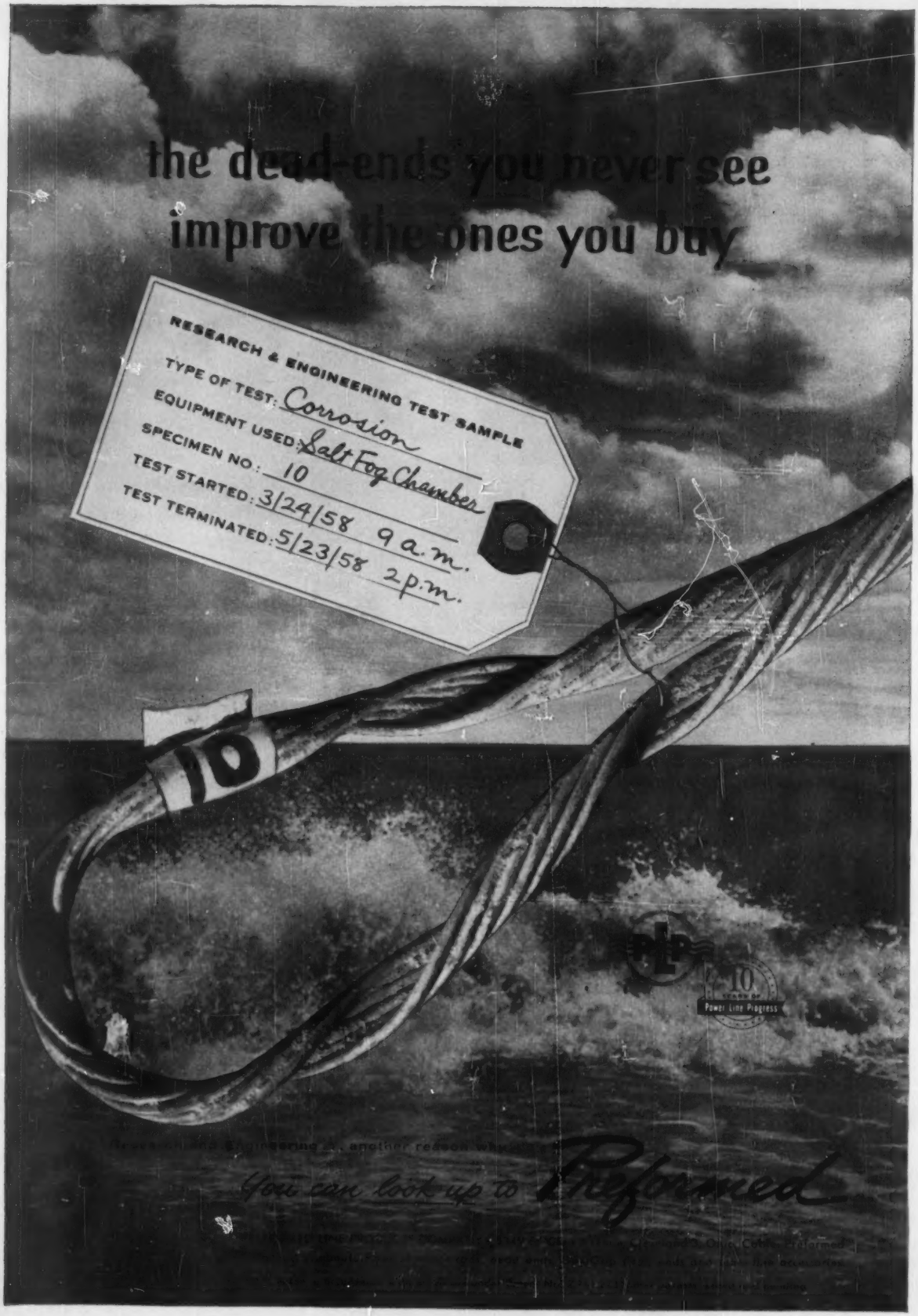
- The first steam turbine generator unit to have water-cooled stator windings is a 450-Mw cross-compound machine with two 265-Mw generators being built by GE for American Electric Power Co's Philip Sporn Plant at Graham Station, W. Va.

In evaluating the significance of the development, last week, GE saw the possibility of generator ratings as high as 1 million kva as well as generator ratings double those now possible with conventional cooling, within the same frame size. Significant savings in power plant construction costs were also foreseen by spokesmen for the company's large steam turbine generator who pointed out that higher rated machines can be installed within the size and weight limitations of present shipping restriction.

- In this connection it is notable that in June GE shipped the heaviest piece of equipment ever to leave its Schenectady plant—a 250-ton stator, part of a 212-Mva generator for Detroit Edison's St Clair Power Plant. This stator will be attached to the high pressure element of a 3,600/1,800-rpm cross-compound turbine-generator unit rated 325 Mw.

To ship it required one of the na-

(*Continued on page 63*)


the dead-ends you never see
improve the ones you buy
RESEARCH & ENGINEERING TEST SAMPLE
TYPE OF TEST: Corrosion
EQUIPMENT USED: Salt Fog Chamber
SPECIMEN NO: 10
TEST STARTED: 3/24/58 9 a.m.
TEST TERMINATED: 5/23/58 2 p.m.
10
You can look up to Preformed

GE Reports Developments

(*Continued from page* 61)

tion's longest railroad cars, a 97-ft depressed center car supported on 24 wheels.

● GE also announced in June that boiler feed pumps associated with TVA's 500-Mw turbine-generator unit now being built for Widow's Creek Power Station will be turbine-driven. Each of the two 10,000-hp, 6600-rpm boiler feed pump turbines associated with the installation will take steam at 487 psi at 647 F. However, they are also designed for high pressure inlet of 2,400 psi at 2,500 F steam for initial starting.

According to engineers of GE's small steam turbine department, the boiler feed pump turbines at Widow's Creek will permit a greater percentage of usable kilowatts to be distributed to users since they will permit a decrease in unit auxiliary electrical requirements. Delivery of the boiler feed pump turbines is scheduled for late 1959.

Cable Trade Names Listed

The third edition of "Trade Marks and Trade Names of Power Cables, Wire and Insulation" has been produced by Electrical World, with the assistance of the Wire and Cable Section of the National Electrical Manufacturers Assn. It is the result of a survey of 60 wire and cable manufacturers. Here is compiled in one booklet all existing cable trade names in the electric power field. Copies at 50¢ each are distributed by Wire and Cable Section, National Electrical Manufacturers Assn., 155 E. 44th St., New York 17, N. Y.

Transformers of Sealed Dry-Type Made by I-T-E

Sealed dry-type transformers are now manufactured by I-T-E Circuit Breaker Co, Philadelphia, Pa. This product addition enables the company to provide the major components—switchgear and transformers—for its entire line of unit substations. Formerly, only liquid-filled and ventilated dry-type transformers were made by I-T-E, and sealed dry-type were purchased.

The new transformers incorporate features such as solid copper secondaries and a unique system for clamping coils to core assemblies.

In addition, shorter lead time on delivery and simplified servicing by the one company are expected to result.

I-T-E unit substations are available for distribution applications in a range of 300 through 2,000 kva, primary voltages of 2.4 through 15 kv, and standard secondary voltages of 120 through 600 v.

MANUFACTURERS BRIEFS

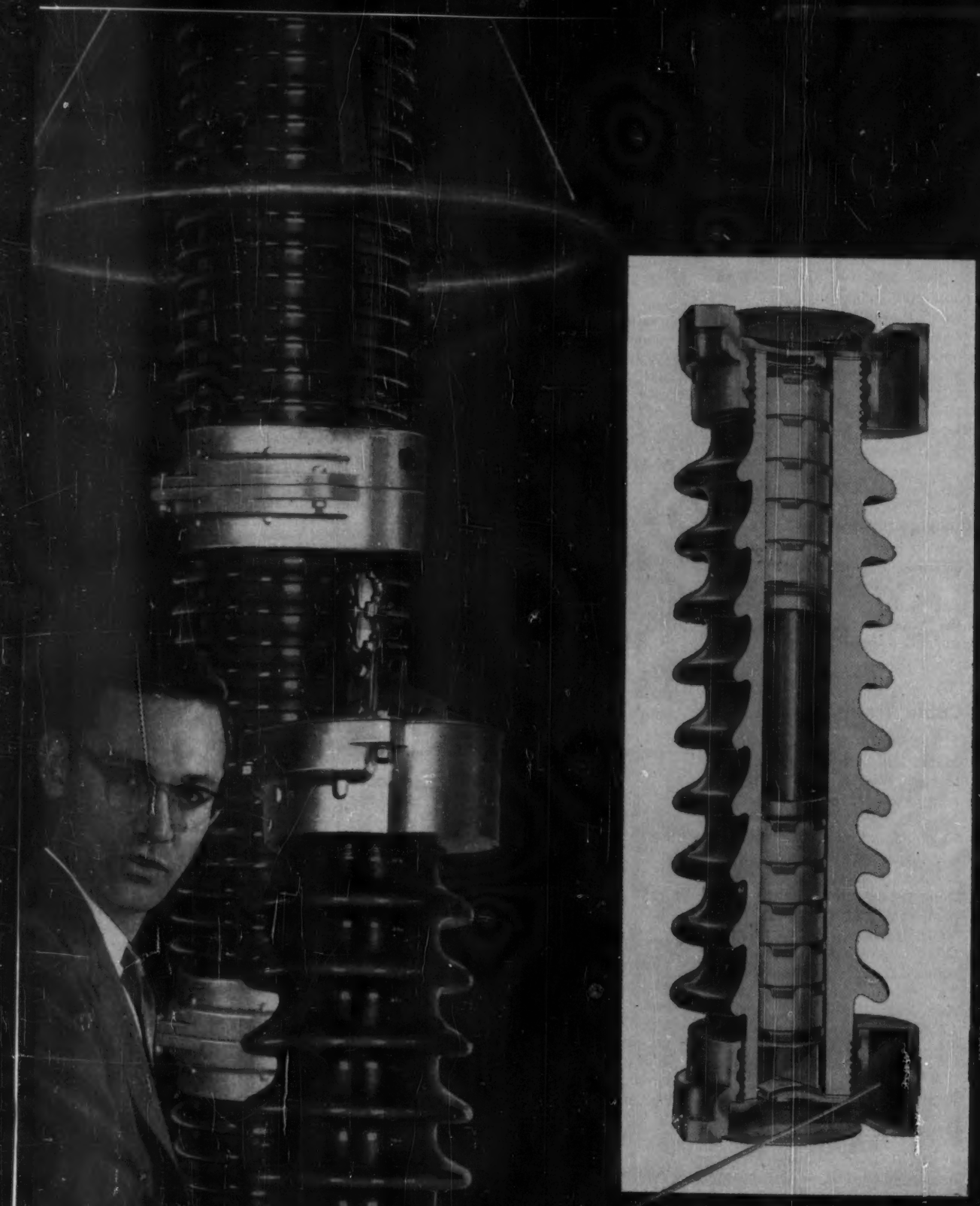
Chase Brass & Copper Co, Waterbury, Conn, a Kennecott Copper subsidiary, has developed a bronze alloy reported to be about five times the electrical conductivity of such alloys. Known as Silnic Bronze, it is composed of 97.5% copper, 1.9% nickel, and 0.6% silicon. It is suitable for electrical parts and maintains its properties at elevated temperatures.

Sangamo Electric Co has purchased the D. G. C. Hare Co., New Canaan, Conn., as a wholly owned subsidiary. Purchase was accomplished through the transfer of Sangamo capital stock. Hare Co. products will complement Sangamo's electronic line. Dr. D. G. C. Hare will continue as president.

RT & E Corp has installed a fully integrated core washer and dryer at its Waukesha, Wis., plant. The new equipment will insure complete removal of all dirt and conducting grit on transformer core laminations. It is expected to help prevent short circuits and losses on the laminations and prevent oxidation and rusting.

De Laval Steam Turbine Co, Trenton, N. J., has terminated, by mutual agreement, its 50-yr association with Turbine Equipment Co, New York, and Turbine Equipment Co of New England as sales representatives. De Laval will establish sales offices in New York and Boston to service all areas formerly handled by Turbine Equipment.

Most metallurgists and product design engineers are aware that laboratory corrosion tests have relatively little quantitative significance in terms of predictable service life. The only valid conclusion which may be drawn from such tests is that the particular samples tested had a certain relative resistance to the specific corrosive environment in which they were placed.
Nevertheless, corrosion proof testing is considered an essential phase of product quality control at the Preformed Research and Engineering Center. In addition to conventional raw material quality control procedures, observations of relative corrosion rates are also made on finished products. As an example of objective performance standards used, Preformed Guy-Grip dead-ends are required to have corrosion resistance exceeding that of the strand for which they are designed. To assure compliance with these minimum quality standards, samples taken routinely from production are applied to strand specimens and exposed to a severe corrosive environment under closely controlled
inspections are also made of field test specimens installed at locations throughout the country which are considered to be representative of arctic marine and industrial conditions. This constant laboratory and field surveillance has undoubtedly been largely responsible for the fact that there has never been a report of a Preformed Guy-Grip dead-end having failed in field service due to corrosion.
Jon R. Ruhlman, Vice President
Research and Engineering



Exclusive Westinghouse venting transfers arc outside in less than ½ cycle.

FROM PLOWBACK OF EARNINGS INTO RESEARCH

ARRESTER EXPLOSION PREVENTED BY ARC TRANSFER

Westinghouse engineers developed a unique arc transfer method which completely eliminates the possibility of arrester explosion and the resulting damage.

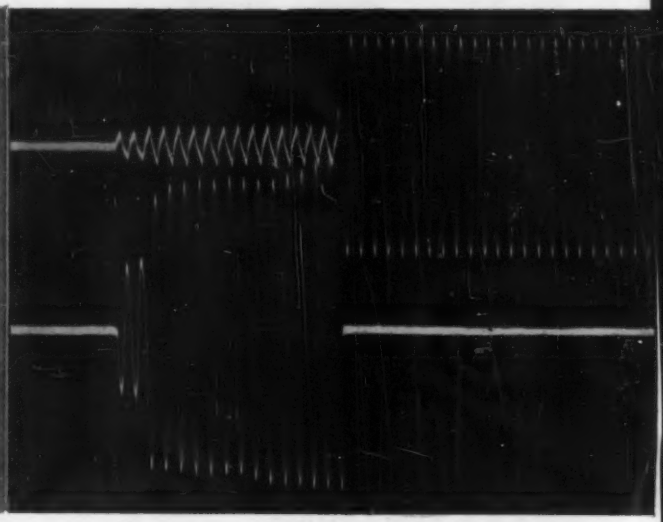
If an arrester does not clear the power follow-current after sparkover, full system short circuit current will flow through the device, with the resulting build-up of tremendous pressure. Unless this pressure is stopped within ½ cycle, the arrester will explode and damage adjacent equipment. Westinghouse engineers in 1950 combined a rupturing diaphragm with exhaust ports which transfer the arc to the outside of the porcelain in less than ½ cycle.

In 1954, after four years of perfect field trials, Westinghouse began applying this pressure relief device to all station arresters.

For complete information about the extra margin of safety in Westinghouse station arresters, call your Westinghouse sales engineer or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-60947

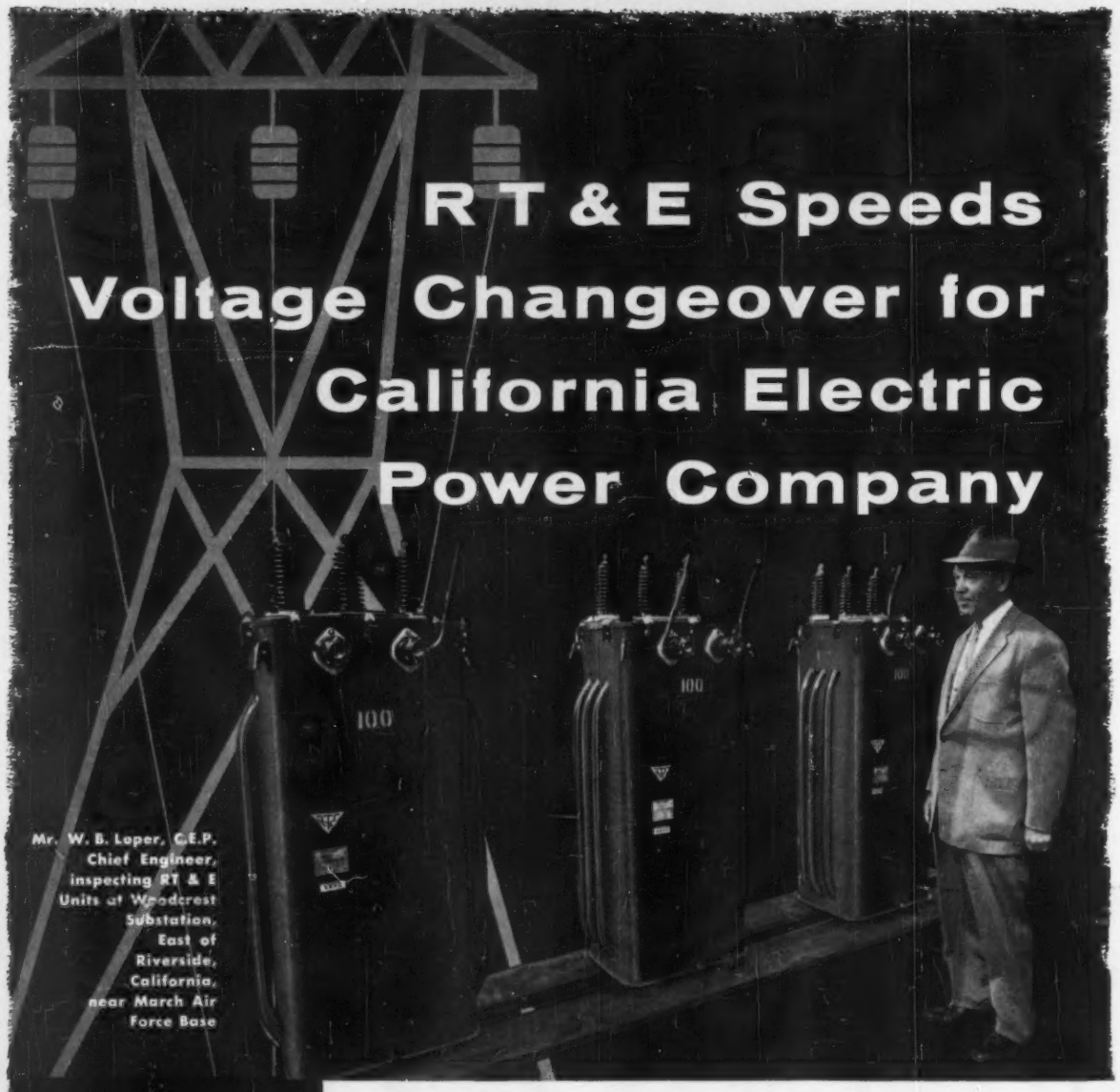
Illustration shows fractured diaphragm of arrester purposely damaged at High Power Lab to create high gas pressure. Vents at either end of the arrester units direct the gas, after rupture, to the outside of the porcelain . . . this path of ionized gas requires considerably less voltage to maintain the arc than in arrester interior . . . thus the arc is transferred outside to the ionized path created by the gas jets. Action requires less than ½ cycle from onset of full fault current.



Oscillogram illustrates action during high fault on damaged SV station arrester equipped with the Westinghouse pressure relief device. After surge was applied to arrester, 42,000 amperes rms of short circuit current started to flow through the unit, and voltage dropped to about 33% of normal crest. After about *15% of one cycle*, voltage dropped to steady-state a-c arc voltage . . . indicating that ionized gases conducting the arc merged outside the arrester porcelain.

YOU CAN BE SURE...IF IT'S Westinghouse

R T & E Speeds Voltage Changeover for California Electric Power Company



Mr. W. B. Loper, C.E.P. Chief Engineer, inspecting RT & E Units at Woodcrest Substation, East of Riverside, California, near March Air Force Base

IMPULSE TESTED

R T & E CORPORATION
Waukesha, Wisconsin

Equipment to help provide power for America

California Electric Power Company faced the problem of making a rapid cutover . . . in areas served from distribution circuits of 2400, 4160, and 4800 volts delta and wye . . . to 12,000 volts.

Mr. W. B. Loper, Chief Engineer of California Electric Power, found after careful study that these cutovers could be made faster and more economically if special 100 KVA transformers were available.

The problem was presented to the R T & E Engineering Department, where swift and careful attention to the problem resulted in a specially designed transformer capable of transforming all three voltages to the 12 KV level.

These special units were manufactured and delivered in record time to meet an emergency condition, saving the utility time and money. Electrical characteristics proved to be excellent, and cutovers were made on schedule.

This type of special service is another reason why R T & E Transformers are being specified by more and more utilities the nation over.

Cable Reel Trailer . . .

. . . with spring-suspended load, frame, and axles handles reels up to 52 in. wide and 96 in. diameter. Torsion bar springs in the Series CM Cable Master Trailer carry load evenly at all times, eliminate trailer bounce and absorb jolts which would speed deterioration of trailer and tires. Trailer can be loaded by one man, before or after hooking to vehicle, without aid of winch or crane. Either side can be raised or lowered to facilitate reel removal on uneven ground. Trailers can be furnished in 8, 10, or 12-ton capacities. Other features are electric brakes and filtered hydraulic system. Reel brake, adapter for 24-in. reels, automatic braking assembly, and directional signals are optional.

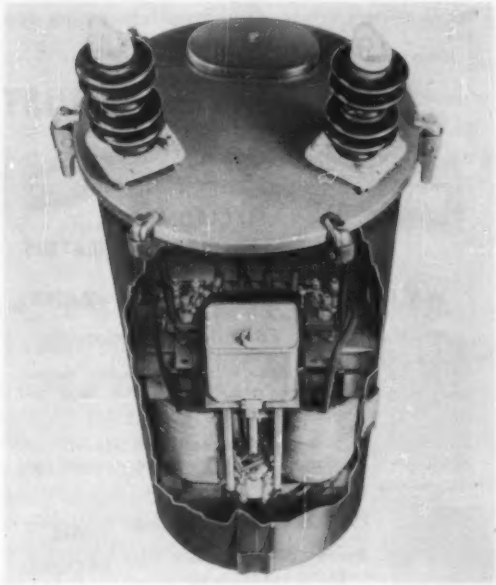
McCabe-Powers Body Co, 5900 N. Broadway, St. Louis, Mo

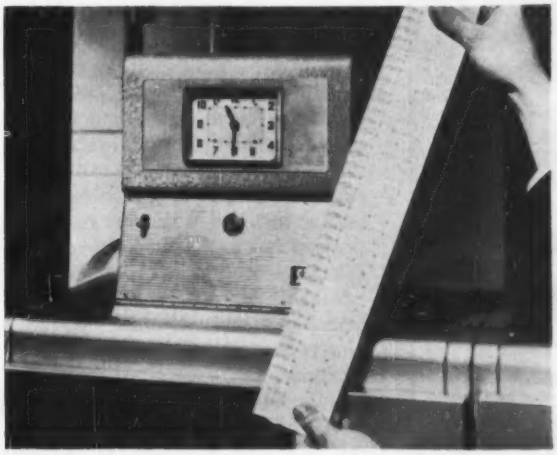
Self-Regulating Distribution Transformer . . .

. . . automatically maintains 120-v secondary voltage with 3.5-v bandwidth. Sensing mechanism monitors utilization voltage and actuates primary tap changer, which alters transformation ratio in 2.5% steps over 10% range. Regulation range can be set to cover 90-100%, 95-105%, or 100-110% of primary rating. Ratings are 10-100 kva, 2.4-14 kv.

Time delay is 40 sec for first change from neutral; 20 sec for later changes in same direction. Losses, in excess of conventional transformers, are a nominal 12 w per unit and are independent of loading and voltage. Potential applications include: 1) the end of long lines; 2) where voltage variations cause erratic voltages 3) on long lines with few customers and 4) maintaining voltage in rapid growth areas.

Line Material Industries, Milwaukee, Wis.





Recording Annunciator . . .

. . . monitors operation of remote or attended power stations and records off-normal conditions, providing permanent, directly readable tape, accurate to 1/100 min. If two equipments go off-normal, first is identified within accuracy of one cycle. Subsequent disturbances are retained and fed to printer in predetermined order at max. rate of 4 per sec. Model RA monitors 8 to 32 points per operational system. Larger units are also available.

Panellit Inc, 7401 Hamlin Ave, Skokie, Ill

(*More New Equipment on page* 68)

BUILD YOUR WINTER LOAD with ELECTROMODE

ELECTROMODE All-Electric HEATERS

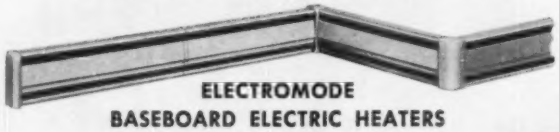
The perfect BALANCE for your Summer Air Conditioning Demands

EVERYWHERE, *more and more people are* LIVING BETTER ELECTRICALLY

and Electromode is ready with the World's *Safest* and most complete line of All-Electric Heaters, to help utilities stabilize their loads on a year 'round basis.

More than 100 Models, specifically designed for the needs of

HOME • FARM • INDUSTRY



ELECTROMODE
BASEBOARD ELECTRIC HEATERS

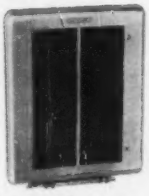
WALL-TYPE FAN-CIRCULATING HEATERS

For All Size Rooms

Bathroom Heaters

Also made in Portable models, modern designs, and capacities for large and small rooms.

Other Electromode HOME Heaters: Radiant Cable Heat and Radiant Convection Panel Heaters



Down-Flo Heater for Big Rooms

Suspension-Type Heater

FOR INDUSTRY

Electromode Heaters are made in Suspension-Type, and Combination Portable and Suspension Heaters, as well as Explosion-Proof Heaters, specifically designed and approved for use in hazardous areas.

ALL AROUND THE FARM

Milk House Heater

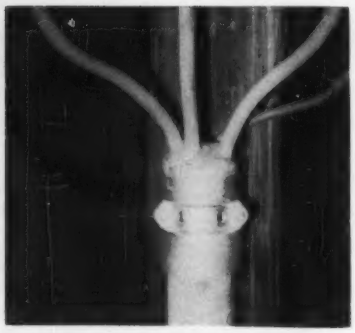
Pump House Heater

Why Electromode is SAFEST!

because only Electromode has the Safety Grid, a completely sealed-in cast-aluminum heating element. No exposed hot wires or glowing coils. No danger of fire, shock or burn. Automatic safety switch prevents overheating.

ELECTROMODE
Division Of
COMMERCIAL CONTROLS CORPORATION

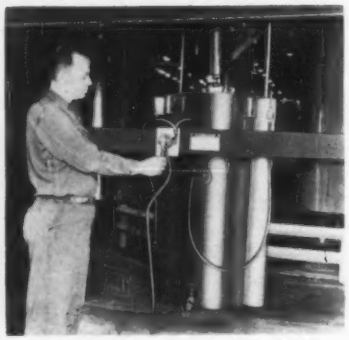
Get Complete Information From
Dept. EW-68 570 Culver Road
Rochester 3, New York



Vented Riser Termination

. . . **permits increase in current carrying capacity** of cable. Available in 2-, 3-, 4-, and 5-in. sizes, the Condulator is easily installed and fits any conduit material. Unit secures any number, size, or configuration of cables against slipping back into conduit and is split in two halves to permit installation or removal with cable in place. Tests indicate ambient air temperature is about 5 degrees lower in vented installation than in sealed one.

Roberts Electrical Products Co, 131 Clarendon St, Boston 16, Mass.



Pneumatic Tank Lifter . . .

. . . **for frame-mounted oil circuit breakers** in 15 to 69-kv class permits man to raise tank in three minutes or lower it in a little over one minute. The lifter comprises two cylinders and a control valve and is self-levelling to assure steady travel. Assembly is light weight and easily installed. Source of compressed air is the air receiver and compressor unit in the pneumatic breaker-operating mechanism. For solenoid operated units, portable air receiver and compressor is available.

Westinghouse Electric Corp, Box 2278, Pittsburgh, Pa.

Plastic Connector Cover . . .

. . . minimizes electrolysis in bimetallic compression connectors and prevents syphoning of water into meter socket. Used with open bottom end or with self-draining bottom cover, Sleeve-In allows cooling air to circulate around compression sleeve. One size fits insulated service drop conductors No. 6 through No. 2/0. It is easily applied and may be installed under all weather conditions.

Sleeve-Ins Co, P. O. Box 1128, Vancouver, Wash.

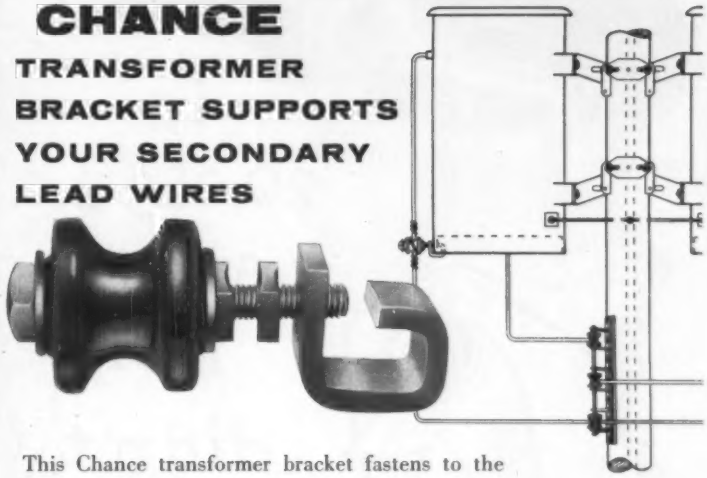
All-Weather Motor . . .

. . . for pumping applications is available in ratings to 2,000 hp. Insulation in this compact, hollow shaft motor has high resistance to moisture and chemicals and high mechanical strength. Bearings can be inspected in five minutes and are protected by oil-metering system and magnet drain plugs that collect foreign ferrous particles in the oil. High motor efficiency permits low cooling air velocity, which reduces entrance of dust and moisture. Bulletin 2450.

Louis Allis Co, Dept P, Milwaukee 1, Wis.

Here's a NEW item in Pole Line Hardware

CHANCE
TRANSFORMER BRACKET SUPPORTS YOUR SECONDARY LEAD WIRES

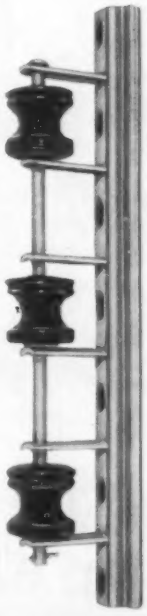


This Chance transformer bracket fastens to the bottom rolled edge of a transformer tank . . . to serve as a firm support for secondary lead wires. Designed to fit all popular distribution transformer tanks, the sturdy hot-galvanized steel clamp and bolt can be quickly and easily attached. Bracket furnished with brown glazed porcelain insulator assembled.

P. S. *Distribution engineers can devise many other uses for this secondary lead bracket.*

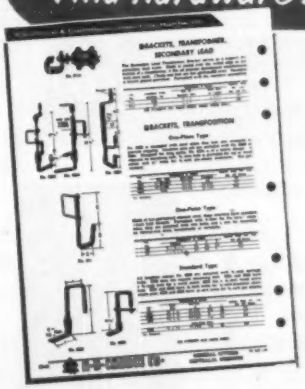
STURDY, ECONOMICAL SECONDARY RACK

Available in light and medium types, this secondary rack features the sturdy, economical staking method of joining the points to the back. The light type is designed for secondary network duty and relatively light loadings, while the medium type is used for intermediate loadings. Made of heavy gauge hot-galvanized steel, the racks are shipped with insulators disassembled unless otherwise specified.



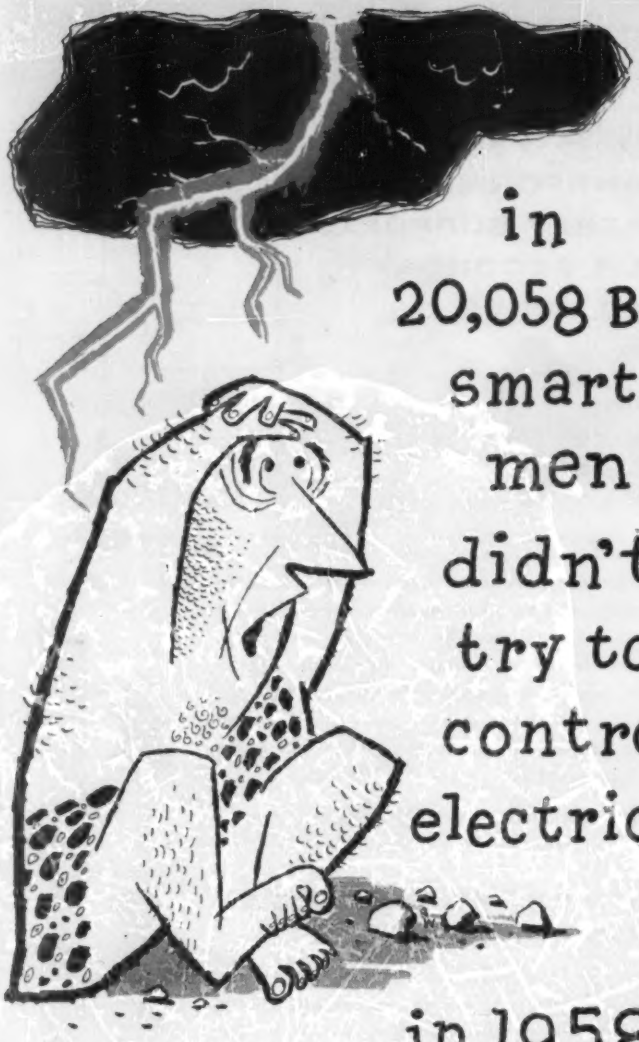
CP58-15

Find hardware information in a HURRY!



"Dictionary style" alphabetized catalog pages enable you to find pole line hardware items quickly from four general sections—Guying Materials, Electrical and Communication Line Hardware, Cable Hardware, Grounding Materials. See your Chance Catalog or send for pages today.

A. B. CHANCE CO.
GENERAL OFFICES—CENTRALIA, MISSOURI
(A. B. Chance Co. of Canada, Ltd., Toronto)



in 20,058 B.C. smart men didn't try to control electricity

in 1958 smart men depend on electrical control equipment from

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

a major source of electrical control equipment for industry

Write for this free booklet just off the press. The Pictorial Index illustrates the wide range of electrical control equipment manufactured by Nelson.

T&D Committee Meets

(*Continued from page* 57)

draulically controlled derricks, crow's nests, and working platforms.

The "sky-hook", long sought for rough-country line construction is within grasp as helicopters prove their worth economically, said L. A. Smith and H. D. Fischer Jr., SoCal-Edison. Fully-framed poles have been set by several California utilities, lead line strung, tower steel and hardware airlifted to sites, and sub-assembled towers completed by helicopter.

With the trend toward helicopter use for transmission construction, Fischer said, tower design will be reviewed, and concepts favoring heavy-duty erection equipment will be replaced by that associated with helicopter handling.

Storm tracking procedure tests show 75% reporting accuracy and effective coverage for Eastern utilities, although routing speed can be improved, reported R. Hicock, Connecticut Light & Power Co.

The tracking procedure and the mutual assistance roster got a realistic workout during the heavy March storms, Hicock continued. An EEI task force is evaluating results.

Acceptable electrical performance data for connection devices will be published soon in a provisional EEI specification, and many commercial connectors will meet the requirements, said F. E. Sanford, Commonwealth Associates. The specifications will call for heat-cycling tests, with resistance and temperature differentials pegged at rated currents. Research underlying the specifications

(*Continued on page* 82)

WHY GUESS?..
TELL TRANSFORMER POLARITY... INSTANTLY!

DICE POLARITY TESTER

Checks all power and distribution transformers . . . through type and split core current transformers.
Self-contained power supply.
Ruggedly built for field, shop use.

J.W. DICE CO. ENGLEWOOD, N.J.

Report on
Junior
Achievement

How Youth Learns about Business

This year, U. S. power companies sponsored over 100 small business firms. Their products ranged from bookends to transistor radios. Some were profitable and some were not. But one thing they all had in common was their value as a training ground for young people in the American way of doing business.

These firms were part of "Junior Achievement", a program of practical business education for high school students which now operates in 36 states, the Territory of Hawaii, and two provinces of Canada. More than 3,400 of these miniature firms did business during the 1957-58 school year, and 3,900 are expected to incorporate in the fall.

Junior Achievement is not another plan to keep kids off the streets. It is an educational program, pure and simple. The boys and girls who participate do so voluntarily, and JA makes no claims as to having rescued any of them from juvenile delinquency. What JA does claim is that it gives interested young people an understanding of how the free enterprise system works.

A check with some of the electric companies sponsoring JA and with some of the youngsters who have taken part in the programs backs up that claim. A typical example is Detroit Edison, sponsor of JA-MAK-IT Co, which manufactured and sold an ornamental wall plaque: George H. Tuttle, Detroit Edison's Director of Public Information and a member of the Junior Achievement board of Southeastern Michigan, said: "There are many organizations to influence the social, religious, and physical welfare of our youth, but, as far as I know, Junior Achievement is the only organization that teaches them how to make a living."

This year's president of JA-MAK-IT put it this way: "I guess we've all learned the basic principles of free enterprise, which means competition, profits, problems, rewards, and making whatever success in business you've a mind to make."

How does Junior Achievement work? Briefly, a group of 15 or 20 high school students are set up in business for themselves. Acting as board of directors, they

form a company, decide on a product to manufacture and sell, elect officers, and capitalize the firm by selling stock—at 50¢ per share par value. The same students then become the production staff. Once production is under way, they also become the sales staff.

Each Junior Achievement company has three advisors from the sponsoring company. They help the youngsters get started, and are always available to answer questions, but they stay in the background and let the students run the business.

The JA company incorporates in October and operates throughout the school year, buying its own materials, paying rent, wages, and "taxes." In May the business is liquidated. If the company has ended up in the red, its assets are prorated among stockholders as in any business that fails. If the company has made money (as is almost always the case) the stockholders receive their money back along with a liquidation dividend.

The biggest dividend is in experience gained by the youngsters. To understand the true value of Junior Achievement, take a look at the story of some of the utility-sponsored JA companies.

Under the sponsorship of Puget Sound Power & Light Co, a group of boys and girls in Seattle went into the business of making and selling shish-kebab skewers. Last fall, under the name of J-Co, they sold 200 shares of preferred stock at 50¢ par value plus 26 shares of common stock (also 50¢) which were bought by members of the firm. They negotiated a 90-day 6% loan from the JA bank for another $125, ordered their materials, and got ready to do a big Christmas business. Then they hit their first serious obstacle. Steel stock to make the skewers was available only from a supplier in the Mid-west. Due to a shipping error, J-Co's initial order was delayed. The delay put the company far behind its production goals for the Christmas market. This meant that J-Co had the task of moving the bulk of their skewers starting in January.

A stepped-up sales program was J-Co's answer. But just as the company was getting its head above water another obstacle to sales appeared. The attractive gift boxes in which J-Co had been packaging their product ran low. Reordering the boxes was adjudged economically unfeasible. So J-Co pulled a new sales

technique out of the hat. The skewers were displayed neatly packaged in the gift box. After the customer had expressed a willingness to buy, the Achiever salesman would suggest that if the customer was going to use the skewers himself, he might prefer to buy them unpackaged at a saving of 25¢, the cost of the box. This technique solved the packaging problem, and J-Co reached its sales goals. Upon liquidation, J-Co's preferred shares returned 10%, with a substantial dividend left over for common stockholders.

At Dayton Power & Light Co, the Junior Achievers have been so successful that they are building a nationwide business. It all started two years ago, when the youngsters of DP&L-sponsored Da-Po Craft decided to abandon their former product and go into the business of assembling transistor radios. They bought a commercially-produced kit, but after assembling it they discovered that it wouldn't work. Undaunted, the members of Da-Po Craft redesigned the kit completely, reassembled it, and came up with a perfectly good transistor radio.

During the first year of this venture, Da-Po Craft sold 35 radios at $16.50 each. For the 1957-58 JA season, the company designed further improvements into the radio and upped its sales goal by 200%. But that wasn't enough for the youngsters. By this time, news of their transistor radio had spread outside of Dayton. Junior Achievers in Columbus and Toledo were interested in making it, and so was a JA firm in Houston, Texas.

The upshot: Contracts calling for the purchase of Da-Po's plans and some of the materials to build the radios. For a $5-dollar fee, Da-Po Craft will send to any JA company a set of plans and specifications for the radio, plus five jigs to speed up production. Junior Achievement firms may also order materials through Da-Po Craft in lots of 25 units at Da-Po's cost plus 4%. In addition, all contracting JA firms agree to pay Da-Po Craft a royalty of 10¢ on each radio produced, payable at the close of business in May.

One of Illinois Power Co's Junior Achievement companies, So-Bo Co of Danville, Ill., picked up experience in several lines of work. It wasn't planned that way. The company organized last fall with the intention of producing a serving bowl. When they discovered that the materials to make the bowl could not be purchased, the Junior Achievers pulled a rapid switch to stay in business. They bought a snow and ice traction material called "Ez-Out", and resold enough of it to tide them over until they could start manufacturing a combination bread and butter board. When they found that the wood scraps left over from this operation were just right for bookends, they began turning them out as a sideline, winding up the year with three marketable products.

New Orleans Public Service backed two JA firms in the business of making planters. The "Why Notters" found they could boost slow sales by adding live plants to their planters. Teenco Specialties abandoned its original design in the middle of the year, and switched to a patio planter which looks like a rustic old oaken bucket. This design was especially popular in the French Quarter of New Orleans. A few enterprising Junior Achievers even turned the planters upside-down and sold some as lampshades.

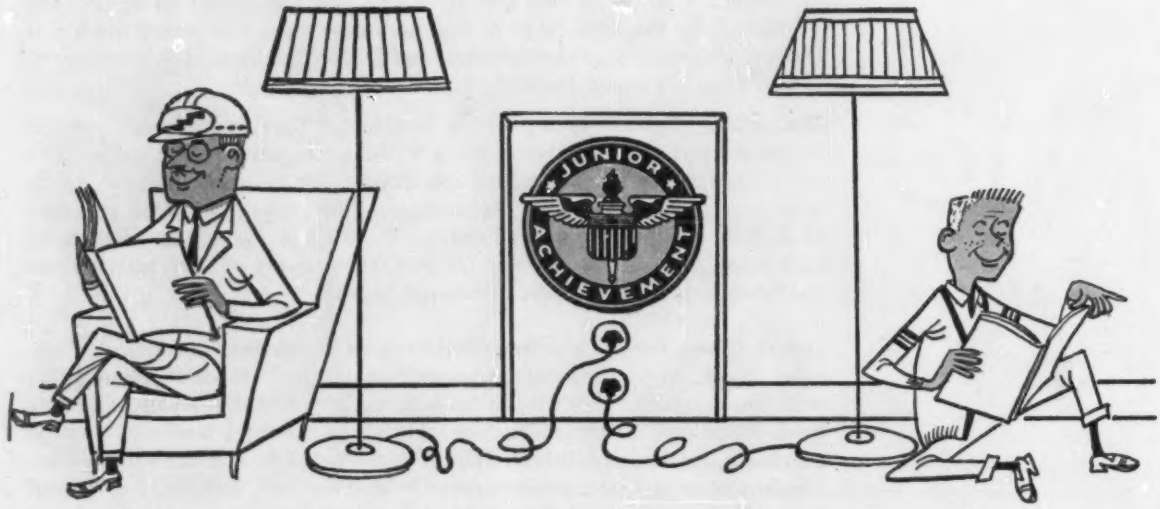
Public Service Electric & Gas sponsored three JA companies. One of them, Clear-Co of Newark, started out last fall making plastic picture frames. When it developed that buffing and polishing the plastic was too time consuming, Clear-Co switched to printing personalized paper napkins, and made enough money to pay a 10% dividend on liquidation.

Albin B. Nelson of PSE&G, one of Clear-Co's production advisers, believes his youngsters got a good idea of how business really works. Like other JA firms, Clear-Co paid $3 a month rent for use of machinery and space at Newark's Junior Achievement center, plus a "tax" payment of $10.60. "There are limitations, of course, on how far realism can go," says Nelson, "but they are not

serious limitations. Most of the kids start out with practically no knowledge of how a business operates, and by the end of the term they have a good grasp of the basic principles. I definitely think JA does a good job."

It's likely the benefits of Junior Achievement stay with the students. Dean Lee S. Evans of Denver University had an idea that past JA members were doing a superior job in college, so he decided to investigate. Dean Evans found ex-Junior Achievers at Denver U in almost six times as many positions of leadership as the average student. He says: "I am sure the impetus of active participation and leadership will carry all the way through their lives."

An outstanding example is John Arnold, former president of the Junior Electric Co sponsored by Public Service of Colorado. He majored in business administration at college because of his experience with JA, and actually opened up his own real estate advertising business while a sophomore. The business was successful, and was subsequently sold out to another group.



Although the biggest benefits of Junior Achievement go to the youngsters who participate, there are some incidental dividends for the companies that sponsor the program. It is unquestionably a fine piece of community relations; it keeps a company in touch with youth; and many power companies have found that the advisers to JA companies gain valuable management experience from the opportunity of watching a miniature corporation operate.

More important, Junior Achievement shows the next generation the satisfactions inherent in free enterprise. George S. Dinwiddie, president of NOPSI, summed it up: "Many young people accept employment today with feelings of antagonism toward a business system they have heard described as grasping and unfair. We have found that a Junior Achievement program provides the basic economic facts, learned through doing, to correct this misinformation."

The JA program is coordinated by a non-profit organization, Junior Achievement Inc, with headquarters at 500 Fifth Avenue, New York 36, N. Y. This organization maintains JA business centers in 222 communities. Companies interested in backing a Junior Achievement program, either personally or with financial contributions, are advised to look up "Junior Achievement" in the local telephone book. If there is no chapter in the community, further information can be obtained from the New York office.

NEW YORK'S COLISEUM USES

ALLEN-BRADLEY

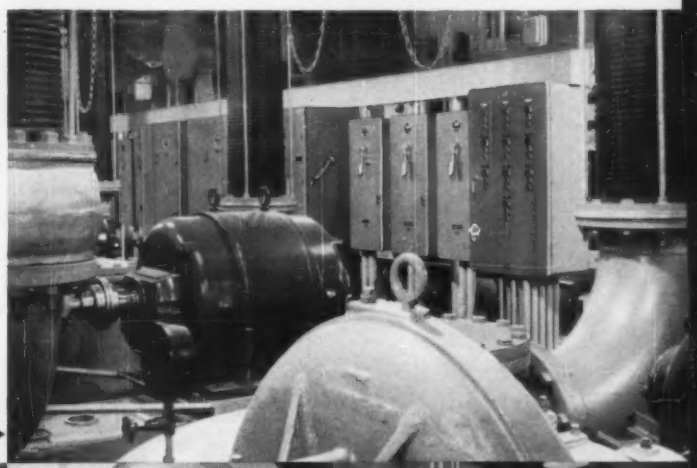
TROUBLE FREE MOTOR CONTROL

Owner: Triborough Bridge and Tunnel Authority
Heating, Ventilating, and Air Conditioning Contractor: Almirall & Co., Inc.
Engineer: Guy B. Panero
Architects: Leon & Lionel Levy

More and more buildings—like the huge New York Coliseum—are being equipped with Allen-Bradley motor control.

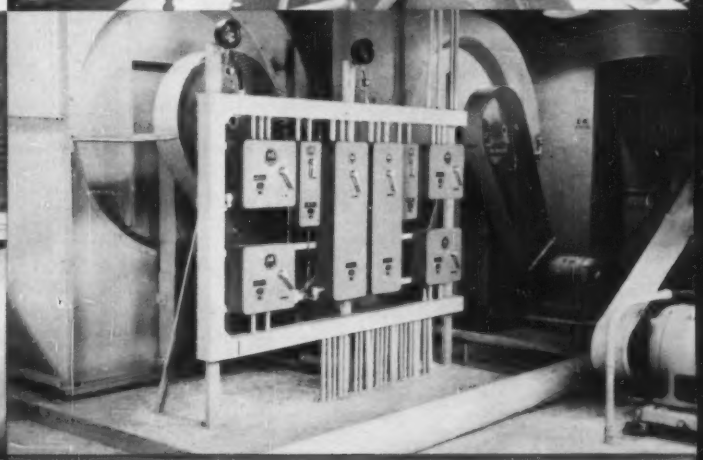
Reliability is the basis for their selection. The simple solenoid—around which all Allen-Bradley motor starters, contactors, and relays are built—has only ONE moving part. This assures millions of trouble free operations. Also, *all* Allen-Bradley magnetic motor control is provided with double break, silver alloy contacts, and contact maintenance is eliminated. These contacts remain in perfect operating condition until completely worn away. The overload relays dependably protect the motor—no matter how long installed nor under what atmospheric conditions they must operate.

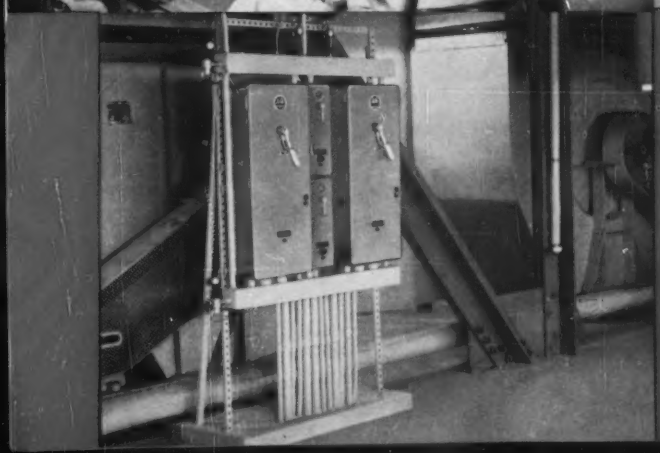
Specify Allen-Bradley—the motor control you can install . . . and forget! Send for catalog, today.



Bulletin 712 combination starters for booster and condenser water pumps. ▼

Bulletin 740 reduced voltage and Bulletin 712 combination starters for chilled water and condenser pumps. ▶





◀ Bulletin 712 combination starters, Size 1 and Size 4, mounted in fan room.

▲ This fan room control panel uses eight Bulletin 712 combination starters—including Sizes 1, 2, and 3.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

8-58-M

Built to ALLEN-BRADLEY Quality STANDARDS!

A-B Control Centers are popular because of their...

Quality Appearance

Quality Construction

A-B QUALITY

BULLETIN 798
Multi-Unit Control Centers

With control centers more than with individual starters, the appearance is often very important—frequently the control center is used as a "show" installation. The "Quality" built into Allen-Bradley Control Centers cannot be beat—it is a "plus" value which you obtain without extra cost.

Naturally, the installation of an Allen-Bradley Control Center provides additional values—such as those outlined below.

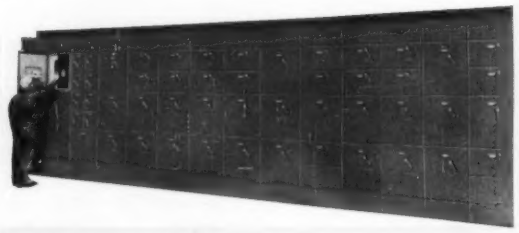
ADAPTABLE TO PLANT CHANGES—Entire units can be moved or complete sections can be added to meet plant changes without the need for changing the internal wiring of the control center.

GREATER SAFETY—Centralized control and locked operating handles prevent tampering by unauthorized personnel. Panels have "dead front" construction with buses and wiring completely enclosed.

MODERN APPEARANCE—This neat, compact installation eliminates the unsightly supporting structures of individually mounted starters and the numerous conduits between separate starters.

LOWER OVER-ALL COST—A-B Control Centers arrive wired and tested. Installation cost is a fraction of that for individual starters. Standardized units eliminate custom engineering.

With Allen-Bradley plug-in type units, starters can be added or removed from the section without disconnecting the rest of the control center from the line.



The long and short of it. A-B Control Centers consist of any number of vertical sections assembled into one unit.

ALLEN-BRADLEY COMPANY

1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

8-58-M

'. . . Electric Heating will break the kwhr barrier . . .' (Continued from page 44)

tronically, from the controlled lighting to the visual-aid electric blackboard, capable of showing a history lesson on film. But he left no doubt that the key—and the starting point—of this dream school is electric heating.

In the last few months, electric utilitymen have been hearing and reading much about the Zinder report (EW, Mar. 24, 1958, p 66). In a second-day kickoff speech, Arkansas Power & Light's W. M. Shepherd, chief architect of the now famous 1,500-heat pump home installation going in at Little Rock Air Force Base, covered the approach AP&L used in selling the all-electric idea to the Air Force.

The complicated purchasing world of the Federal government, plus the rough competition of a know-how gas utility, made Bill Shepherd's task seem impossible. Shepherd set down several points for an electric utility with a possible government agency multiple housing customer:

Tips on Selling the Gov't.

- Have a "pipe line" of information—to know when multiple housing is being considered for your service area. The power company must get into the act early.
- Contact the people with whom you will be dealing—all the way along the military or civilian agency lines to Washington. In the case of public housing, it is the local and regional offices of PHA. "There must be established a personal relationship that develops faith and confidence in the integrity of your intentions."
- Cultivate and educate the architects and engineers on the project. Don't assume they will be well informed about electric heating. Go over with them all the details of electric heating of all kinds, in order to help them design the most useful and economical home.
- Be sure the proper application of electric heating is included in bidding specs.
- Make preliminary studies of original and operating cost comparisons, and the "plus benefits" accrued with type of application.

In a round of panels on resistance heating and heat pumps, manufacturers pegged the market possibilities for each in residential commercial and industrial applications. Most agree the future of both types of equipment is bright. Generally, speakers felt resistance heating for residences would be in the less expensive homes; the bigger, more expensive ones in which air conditioning is a possibility will probably go to heat pumps. But the gap is narrowing, and will continue to get smaller as new methods and refinements shave the prices of heat pumps.

Heating Gains Recognition

Commercially and industrially, resistance heating and heat pumps are coming to be recognized as an important factor contributing to employee health and morale (and in some cases, product quality). This, plus the savings they afford in initial plant cost, plus the flexibility both offer (zone control), are proving to be the salient points in selling them.

These were the arguments for resistance heating by men like Berko's Dave Knoll, Wiegand's Fred Kreiser, and Cavalier's Mel Wessel. Likewise, the heat pump tune was sung by Westinghouse vp Bruce Henderson, and GE Weathertron's Paul O'Neil.

In an attempt to peg the importance of reverse-cycle room coolers, Fedders-Quigan President Salvatore Giordano said, "It is . . . the room unit that is going to spell the success of year round heating and cooling with heat pumps"—just as, Giordano argues, it was the room unit that put air conditioning on the map.

Wiegand's Vice President Bruce Fleming called for greater utility-manufacturer effort in pushing both electric heating and heat pumps, maintaining that it was the only way to an all-electric future.

Builder Says 'Sell Advantages'

What role in electric heating does the builder play? A big one, said Jack Worthman of Fort Wayne, himself a builder-advocate of electric heat. Worthman's advice: "Sell the advantages, and the price will take care of itself."

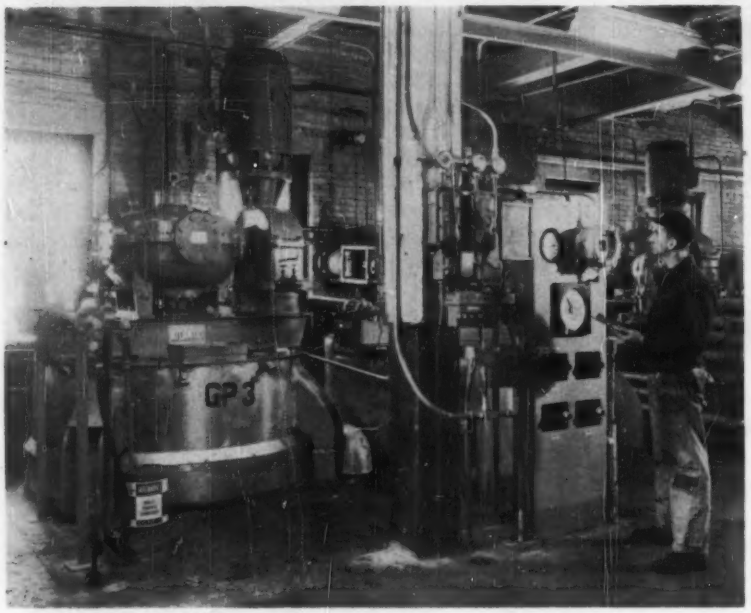
Electric heating is gaining support from other quarters besides utilities and manufacturers, according to Live Better Electrically's R. E. Ingmire. Citing a recent National Association of Electrical Distributors survey that showed that 90% of NAED members sell heating equipment, Ingmire went on to talk of the help to come from United Mine Workers, whose interest in electric heating is—and should be—more than casual. But Ingmire's heart was in that which he knows best: LBE's Gold Medallion Homes program (EW, Oct. 28, 1957, p 47). And well it should be, for GMH was pretty much his creation. With 108 utilities now supporting Medallion Homes, and more coming into the act every week, it holds perhaps the greatest promise of any residential market development program to put new home kwhr consumption up in the brackets where it should be.

To find out how GMH will get it there, listen to Ingmire: "Let's take a look at the figures involved in the Gold Medallion Home, and I think you will see why it constitutes such a powerful incentive to so many parts of our industry. In the first place, a Gold Medallion Home will use between 20,000 and 30,000 kilowatt-hours a year, in contrast to the average new home, which will use 3,500 kilowatt-hours per year.

"In terms of installed electrical equipment, the Gold Medallion Home will require $500 in wiring, service equipment and devices against $160 for the average home; $300 in lighting as against $50 in the average home; and $5,200 in appliances and electric heating and cooling equipment. The dollar difference—$4,800 per home. You can take out your slide rules if you want and figure out what a six-time increase in kilowatt-hour consumption, and a five-time increase in installed electrical equipment means to utilities and manufacturers over the years to come."

It will mean plenty.

Reprints of this report, plus complete conference papers are available from Electrical World at $10 the set.



Using built-in electrically heated system . . .

Kettle Cuts Expansion Costs

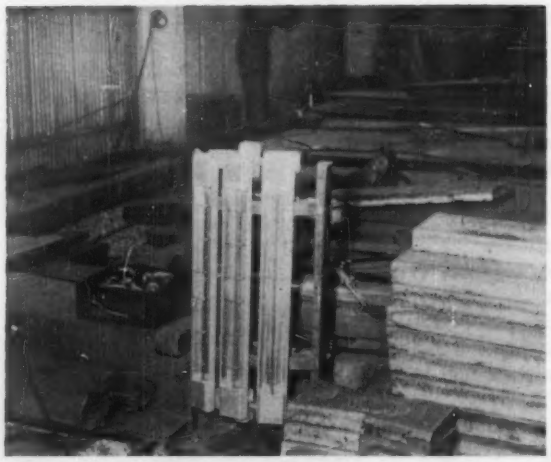
A self-contained, electrically heated kettle enabled the Atlantic Refining Co, Philadelphia, Pa., to expand their high temperature grease-making capacity with a minimum of expense and effort. The 1,500-gal. unit has four built-in 55-kw immersion heaters and a self-contained supply of Dowtherm which eliminated the expense of a new boiler and additional pumps that a conventional kettle would have required.

Efficiency Is Higher

Efficiency of the new unit is 20% higher than that of a gas- or oil-fired unit. Its full heating efficiency is maintained regardless of the rate of heat input required by the process. With fewer pieces of auxiliary equipment, this kettle requires less maintenance work. Moreover, there is no boiler, pipe, or valve maintenance to force periodic shutdowns of production. Operating temperatures up to 700 F are possible, so that a single unit can be used to make a variety of greases. Complete instrumentation and control of the fast-acting electric heaters assure positive, rapid changes in heat input to match process requirements.

This is the first installation of this type in the grease industry although the equipment has been widely used in chemical plants. The kettle combines the advantages of electric heating and Dowtherm heating without the maintenance requirements of conventional Dowtherm equipment. In addition to the heating load, the kettle has a 50-hp, variable speed motor. Heaters and motor both operate at 440-v, 3-phase.

Portable Infra-Red Heaters Replace Oil-Fired Units



DONALD W. RUNQUIST, Commercial & Industrial Sales Manager, St. Joseph Light & Power Company, St. Joseph, Mo.

Infrared lamps have replaced the old-style, oil-fired stoves formerly used to provide employee comfort in the main plant buildings of the St Joseph Structural Steel Co, St Joseph, Mo. Although the old units provided some warmth for the employees, the new units are superior in that there are no combustion products and no time is lost in starting them up. The five 1,100-watt units are attached to a dolly so they can be easily moved from place to place. The main plant buildings have no central heating system.

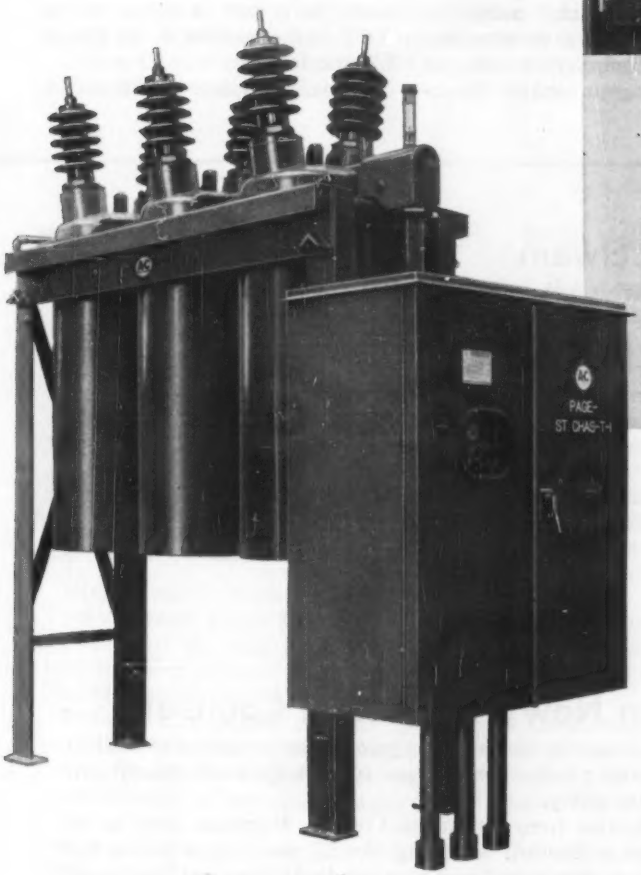
The customer is so well pleased that he has made two additional installations in the shop. The company fabricates structural steel for use in bridges, buildings, and highway construction.

for reliability

for ease of maintenance

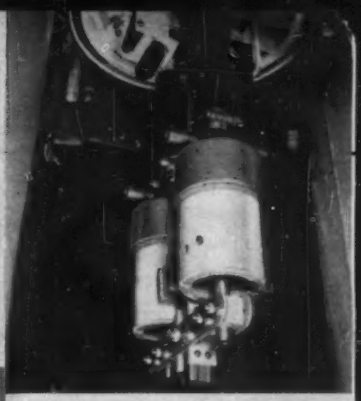
for ease of operation

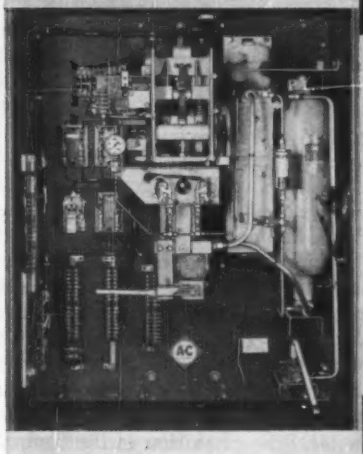
...3 top breaker features



❶

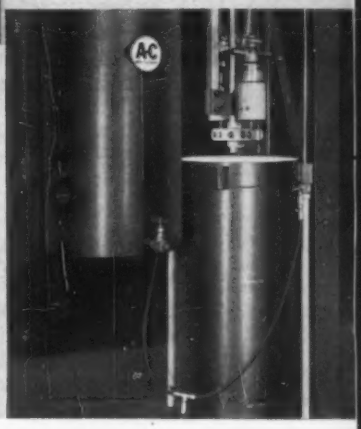
Fast contact opening and closing proved by time and laboratory tests. *Turbo Ruptor* device features bayonet and segmented tulip for wiping action, positive contact and absorption of mechanical impact.





❷

Simple design, with few moving parts . . . the *Pneu-Draulic* operator offers many advantages. Dust, dirt, moisture, heat and cold are no problems. Field-proved in dozens of utilities.



❸

Full access to tanks and contacts unobstructed by framework. In addition, optional power-operated hydraulic tank lifter eliminates hand cranking, makes it safe and easy to lower and raise tanks.

Allis-Chalmers large frame-type breakers have many quality features

Careful attention was given to every detail of design and construction. The result: today's top breaker value!

In addition to the features pictured above, you'll find self-cleaning, smooth, fabricated steel tops for each tank; ball-type position indicator visible from greater distances; float-type oil gauge that eliminates leakage; full tank skirt for added stability when tank is on ground.

For details, contact your nearby A-C office or write for Bulletin 71B8475. Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

A-5672

ALLIS-CHALMERS

Pneu-Draulic and *Turbo Ruptor* are Allis-Chalmers trademarks.

Con Edison of New York Makes Top Promotions

In top level advancements at Consolidated Edison Co of New York, Bernard E. Gallagher and Gerald R. Hadden have been elevated to vice president, and Charles W. Franklin and Gordon R. Milne have been appointed chief electrical and mechanical engineers, respectively. Also Arthur N. Anderson becomes an assistant vp.

Gallagher joined the system in 1930 after graduating from Bloomsburg State College, Pa. He first handled meter and test work for Con Edison while attending Columbia University night school, where he earned his MA degree in 1934. In 1935 he transferred to the company's personnel section, eventually becoming wage coordinator.

From 1940-50 he served in the utility's management development program, gaining diversified experience in construction, production and accounting. He returned to his specialty, industrial relations, in 1954, and in 1956 was named assistant vice president, industrial relations.

Hadden began his Con Edison career in 1931, immediately after his graduation from Rensselaer Polytechnic Institute as a mechanical engineer. He left the company in 1940, to serve in the U. S. Navy, and was subsequently discharged as lieutenant commander. Back at Con Edison, he was selected for the management development program. His responsibilities included public relations work as well as direct supervision of the company's natural gas conversion program and of the activities of its field emergency crews.

In 1956 he was chosen assistant vice president, and assigned to Con Edison operations in Westchester County, New York. Last year he assumed command of the company's over-all construction program.

Franklin, Con Ed's new chief electrical enginer, is a Georgia Tech graduate. He joined the former United Electric Light & Power Co in 1916, and, except for a brief interlude of Army service, 1917-18, worked in various engineering capacities there until the merger of that firm with Con Edison.

Actively engaged in association work, he is both a Fellow in the AIEE and a member of the Edison Electric Institute.

Milne, a graduate of Stevens In-

New Jersey Utilities Up McElwain

William H. McElwain, vice president, engineering and operations for Jersey Central Power & Light Co and New Jersey Power & Light Co, has been elected executive vice president of both utilities.

McElwain attended Rensselaer Polytechnic Institute, graduating as a mechanical engineer in 1926. His first utility experience was with the New York State Electric & Gas Corp; a company he served for 23 years, until 1949, when he resigned to become superintendent of operations, Metropolitan Edison Co.

While at Metropolitan Edison McElwain became vp, western division, and eventually vp, operations, for the entire utility. He left his position there 18 months ago to accept his present employment.

Waterman New VP-General Counsel

Iowa-Illinois Gas & Electric Co has announced the promotion of William B. Waterman to vice president and general counsel. He was formerly general counsel for the utility.

After his graduation from Dartmouth College, Waterman went on to attend Law School at Harvard University. For 17 years before joining the Iowa-Illinois organization he had been associated with Lane and Waterman, a Davenport, Iowa, legal firm.

He came to Iowa-Illinois in 1952, serving first as assistant general counsel, and in 1954, as general counsel. He is a member of the company's management advisory board, and has served for two terms as board chairman.

B. E. GALLAGHER

G. R. HADDEN

G. R. MILNE

C. W. FRANKLIN

stitute of Technology, has been with the Edison engineering department since 1921. In 1943 he was appointed to the executive development program, where he eventually became superintendent of the East River Generating station. In 1947 he was elevated to manager of systems operation, and the following year, to mechanical engineer.

He has worked on the design of the Indian Point plant since its inception, and has authored a paper on the project, slated for use at the UN conference on the peaceful uses of Atomic energy to be held this Fall in Geneva, Switzerland.

Anderson has been with Con Edison since 1933. A mechanical enginer, he has participated widely in the design of nuclear reactors, and has served with the Atomic Energy Commission in the capacity of power engineer.

PERSONAL BRIEFS

Philip H Powers, president, West Penn Power Co, has retired after 44 years of service in the utility industry.

New auditor and chief accountant for Southern Indiana Gas & Electric Co is **Earl P. Huber** . . . **Donald Emerson** has been named new superintendent of overhead lines by Detroit Edison Co.

Jersey Central Power & Light Co has appointed **Edwin M. Ambler** as manager of its coast division; taking his place as coast division sales manager is **George A. Northridge. William A. Kollmayr** steps up as southern division sales manager, and **George R. Engles** takes on added duties as farm sales manager.

Walter H. Sammis, president, Ohio Edison Co, has received an honorary doctor of laws degree from Thiel College and the University of Akron for "outstanding achievements in the field of industry and of higher education."

As part of a broadened executive development program, Atlantic City Electric Co has re-shuffled its top management personnel. **John B. Taylor,** former vp, commercial activities, becomes vp, production; **Waldo E. Caven** moves from vp, engineering and production to vp, engineering and operations; and **James P. Hayward** leaves his post as vp, operations, to become vp, commercial activities.

In recent advancement at Detroit Edison Co, **Anthony Maihofer** was named secretary of the utility.

Arnold Christensen has been elevated to system operator at the Poughkeepsie electric station, Central Hudson Gas & Electric Co.

Brian Miracle, commercial salesman for Pacific Power & Light Co, has received national recognition for his talent with numbers, winning the "outstanding research" award of the National Foundation of Applied Mathematics.

At Graybar Electric Co Inc, recent promotions place **P. J. Zimmermann** as operating manager at Harrisburg, Pa, and **J. C. Finegan** as operating manager for Washington, DC.

C. E. Price has been appointed southeastern regional manager of Westinghouse Electric Corp's manufacturing and repair (M&R) division.

Newly appointed to the post of merchandising coordinator for the Norge division of Borg-Warner Corp was **William H. Chase.**

General Electric Co has appointed **I. W. Pittleman** manager of its factory branch air conditioner department in the Cleveland area; **H. W. Gerte** is operations manager. New manager for GE's New Jersey air conditioner factory branch is **A. S. Garven.** At the same location, **Ian Dennis** has been named sales manager and **Gordon Deso** operations manager.

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T&D Committee Meets

(*Continued from page* 70)

has shown clearly that connection stability is the real quality criterion.

Industry standardization of sleeve connectors is today's most important connection problem, in view of the enormous stocking, supplying, purchasing, and tooling involved. Portland General Electric Co recently adopted standards for aluminum-bodied compression-type sleeves for non-tensioned circuits, announced S. P. Samsel. All sleeves will have nominal ⅝-in. OD with 2-in. minimum length to allow good connections with ⅝-in. standard trade dies.

Significant reduction in electrical accidents with cranes, derricks, and booms, despite enlarged exposure due to highway programs, has been accomplished since 1955 by SoCal-Edison, reported F. C. Hulbert. Intensive educational campaigns, including safety bulletin distribution, personal letters, and use of audio-visual aids were credited.

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America's First Wire Fence—since 1883

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PAGE will help you to choose the RIGHT fence for YOU from a wide variety of fence styles and four superior fabric materials—including the new ACCO Aluminized Fabric. For information and name of nearest Association member, write for Folder DH-26.

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- **STANDARD DUXSEAL** is a permanently plastic gray-green compound utilizing a non-drying, vegetable-oil vehicle. It will not corrode metals, plastics, wood, rubber, or painted surfaces. It adheres well to all common materials. It is non-staining.
- **TYPE N DUXSEAL** has the same properties plus higher resistance to bleeding or dripping at high temperatures.
- **R-100 DUXSEAL** employs a resinous material as its vehicle and has the same properties. It skins fast to provide an excellent paint surface.

A wide range of other J-M Sealing Compounds is also available in pocket rolls. These are described in sheet EL-85A. Duxseal is covered in sheet EL-68A. Write Johns-Manville, Box **14**, New York 16, N. Y.

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3—1000 KVA Penn 33000-2400/4160Y
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3— 500 KVA W-H 13200-2300/4000Y
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3— 333 KVA W-H 13800-240/480
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Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
5316 Hetzel St.
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45 Years' Dependable Service

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFGR.	VOLTAGE
4	1667	Mol.	69,000-34,500
3	1000	G.E.	66,000-33,000
3	1000	G.E.	66,000-2300/4000
3	667	Kuhl.	65,000-480
1	2000	West.	44,000-2400, 3Ph.
3	200	West.	44,000—480
1	5000	West.	34,500-13750/6875, 3Ph.
1	3750	G.E.	34,400-13800/7960, 3 Ph.
2	3000	Stand.	33,000-4160, 3 Ph.
1	1500	Mol.	34,500-460, 3 Ph.
2	1500	G.E.	34,400-2520, 3 Ph.
3	1000	A.C.	34,650/11,500-2300
3	200	A.C.	34,500-2400/7200/12470Y
1	3000	A.C.	23,380-2500/4330Y, 3 Ph.
3	1250	G.E.	26,400/13,200-2400/4150
2	1500	G.E.	23,000-2400/4800, 3 Ph.
3	100	G.E.	22,000-7200/12470Y
3	2500	G.E.	13,800-2300, 3 Ph.
3	1667	G.E.	13,800-600
3	667	Kuhl.	13,800-480
1	600	Stand.	13,200-2300, 3 Ph.
1	450	Penna.	13,200-2400, 3 Ph. Askarel
3	333	Uptegraff	13,800-480
1	4500	West.	7200-2400, 3 Ph.
3	333	G.E.	7200/12470-480
3	125	A.C.	6900-2300
3	100	G.E.	4800-120/240
3	333	G.E.	2400/4160-600
3	150	West.	2400-230/115
3	100	G.E.	2300/4000-230/460

FEEDER REGULATORS—Outdoor

1	750	G.E.	360 A. 12000 V. 3 Ph. STEP
1	500	G.E.	694 A. 4160 V. 3 Ph. STEP
1	250	A.C.	601 A. 2400 V. 3 Ph. STEP
3	96	G.E.	200/400 A. 2400 V. 1 Ph. IND
8	36	West.	150/300 A. 2400 V. 1 Ph. IND

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Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
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The "Weasel" played an outstanding role in the snow blizzard of 1958, working 24 hours around the clock.

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For Sale at bargain prices:

3	150 HP Motors with starters (1 new)
25	Transformers, 5 KVA to 200 KVA
2625 Ft	Cable, 350 MCM, 3C, 3 KV
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POSITIONS VACANT

Wanted—University graduate Engineer with at least five years experience operation steam electric generating station for responsible position in Maracaibo, Venezuela. Preference will be given Spanish speaking applicant. Salary dependent on qualifications. P-8320, Electrical World.

Middle Atlantic State. Graduate Electrical Engineer as Superintendent to take charge of electrical generation, distribution and metering. Municipal, 20,000 population. Steam. Send full resume including references and salary requirements. P-8179, Electrical World.

DON'T FORGET THE BOX NUMBER

Service Voltage Needs Research (*Continued from page 46*)

The "twice present" system would have all the favorable and unfavorable features of present practice. It does not appear necessary to list these. But it is reasonable to expect that a judicious application of wye and delta systems as in best practice today can gain considerable economies. For example, the savings possible with 4-wire delta instead of 4-wire wye for small 3-phase commercial loads is well known. It would be expected that 416-volt, 440-volt and 416/440-volt motors would be used at this higher level in about the same way as motors of half these voltage ratings today.

The step to higher utilization voltage is of tremendous economic consequence. Utilities have shown an inclination to accept 265/460 v for commercial service, in many cases at the insistence of consumers or their representative. The 265/460-v system shows savings where it is selectively applied. But it is believed that these savings are possible only at a much greater expense to users of single-phase equipment.

All are agreed that a higher utilization voltage level is necessary in the commercial field. However, it appears that more basic information must be assembled before one system or a combination of systems is an obvious choice.

Load-Growth Curves Normalized (*Continued from page 49*)

3,651,352 Mwhr — 29,000 Mwhr = 3,622,000 Mwhr adjusted net system load

The net system load curve adjusted to normal degree-days is shown in Fig 2 with actual net system load and actual degree-days shown also for comparison. Most significant changes in the degree-day curve are reflected in the actual net system load curve, but the normalized plot has eliminated these.

The calculation indicates that the sample adjustment, 73 Mwhr per degree-day, applied to the 52-week total temperature-affected load of 367,000 Mwhr, about 10% of total net system load. This percentage holds constant, indicating that temperature-sensitive load increases at the same rate as total net load.

Ground-Fault Neutralizers Used (*Continued from page 49*)

penses with the need for expensive terminal manholes for phase collection at the generator unit and at the main transformer bank. A single manhole near the center of the generator duct line provides for drainage and splicing if necessary and also for grounding the cables' metal shielding tapes at the center of the cable run.

In this way the generator unit is connected into the unit scheme and the three-winding, step-up transformer bank to the 115 and 23-kv switchyard structures in the outdoor yard. There are no circuit breakers in the 14.4-kv generator connection, but there are electrically operated 14.4-kv disconnects at the step-up transformer structure. This arrangement permits transformer operation from the 115-kv structure to the 23-kv structure when the generator unit is out of service.

Provision has been made to allow forced-air cooling through the fibre ducts in the future if necessary. Thermo-wells extending vertically from the station floor down to and adjacent to the duct banks permit periodic temperature measurements of duct conditions by portable instruments during generator operation.

Cable terminations at the generator end are just above the station floor, and generator connections from the indoor cable terminations to the generator stator terminals are made with 9 x 9 x ¼-in. unventilated hollow square copper tube. The tube is insulated with varnish cambric tape and protected by an overall asbestos tape covered with fire-resisting paint.

Taped expansion connectors between the copper tube and stator terminals minimize mechanical stresses on generator stator terminals.

The cable system in lieu of an insolated-phase bus duct construction for generator leads is expected to yield a saving of $123,000, according to present estimates.

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LET US PROVE WE HAVE A BETTER ~~MOUSETRAP~~ Distribution Clamp

NEW Extruded Aluminum Clamps For Copper and Aluminum Conductors

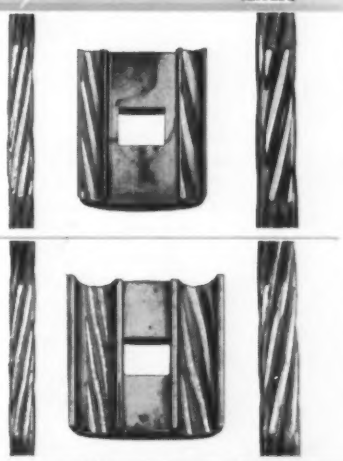
- SINGLE BOLT CONNECTION
- NO COPPER LINERS
- CAPTIVE PARTS
- EASY INSTALLATION
- EXCELLENT CONDUCTIVITY
- LONG SERVICE LIFE
- AVAILABLE WITH NO-MELT INHIBITOR

Extensive tests uphold the design of these Reliable Clamps — the use of extruded shapes, the mass anode principle and a single hex-head bolt. There is plenty of metal with lots of space between conductors. Clamps are tightened with wrench against wrench.

STRAND CONTACT

Picture shows strand contact area in the Reliable Distribution Clamp. Tightened to normal torque, every one of the six outer conductor strands has adequate contact area at sufficient pressure to maintain current carrying ability even for overload and fault current conditions. Strands were treated so contacts would show.

Available in three sizes for conductors 6 to 1/0, 2 to 4/0 and 1/0 to 336.4



Write for supporting data and sample clamp to suit your conductor.

A HALF CENTURY OF SERVICE TO THE UTILITIES

Reliable ELECTRIC COMPANY • FRANKLIN PARK, ILL.

MOLONEY "SELECT-AMP"

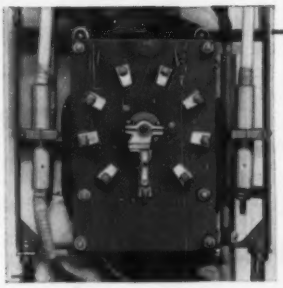
POLE TYPE STEP VOLTAGE REGULATORS

. . . provide an efficient, economical answer to your voltage regulation problems.

The component parts of Moloney "Select-Amp" Pole Type Regulators have the same carefully engineered, high quality construction found in all Moloney transformers. Here are some of the features of this regulator . . .

"Select-Amp"—The Moloney "Select-Amp" feature is controlled from the position indicator and allows the range of voltage regulation to be adjusted from a maximum of plus or minus 10% to a minimum of plus or minus 5%. Reducing the range of regulation to plus or minus 5% permits increasing load current to 160% of normal rating. The voltage is raised or lowered in ⅝% steps.

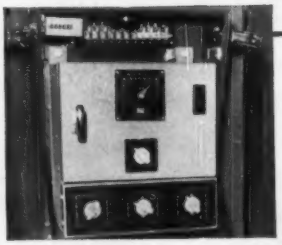
Position Indicator—is directly coupled to the drive mechanism. Resetable drag hands on the position indicator indicate the highest and lowest position the regulator has reached. These drag hands may be reset by operating the reset lever with a hook stick. The position indicator is mounted at an angle to facilitate observation of indicator from the ground.



Moving Contact Assembly—consists of arc-resistant copper tungsten contacts contained in beryllium copper clamps, aligned with beryllium copper springs and compressed with coil springs to obtain correct contact pressure. A spring loaded accelerator provides "quick-break", "quick-make" action to all switching, thereby minimizing arcing time, consequently reducing contact wear.

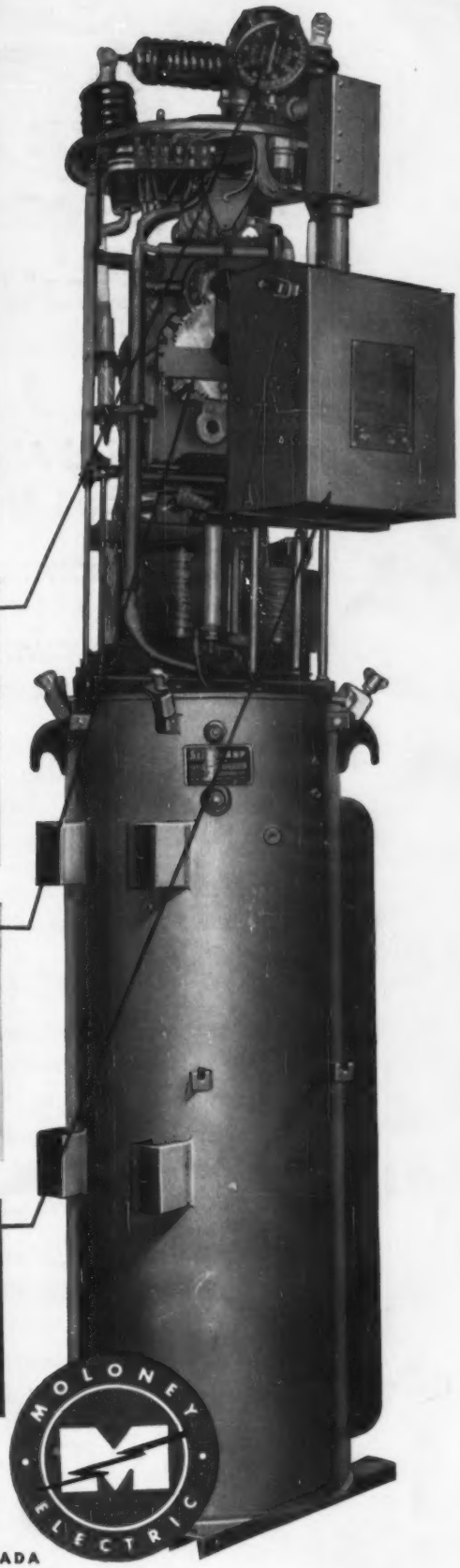
Stationary Contact Blade—is made of copper chrome alloy and is tipped with copper tungsten to minimize arc erosion.

Mounting Panel—is made of heavy bakelite to provide an insulating panel for mounting the switch contacts.



Control Cabinet—The hinged front cover is gasketed and is secured by toggle clamps thereby affording both weather-proofing and accessibility. The toggle clamps are provided with padlock eyes so that the cabinet may be locked to prevent tampering. The cabinet is bolted to brackets on the tank wall and may be removed for mounting at the base of the pole.

Operations Counter—An electrically-operated operations counter is provided in the control cabinet. This counter provides an accurate record of the number of tap changes made during any interval of time, providing useful information which can be used in setting up maintenance schedules.



MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA